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ABSTRACT

Proceedings of the 1984 CAUSE conference on information management and new technologies are presented. Contents include 49 papers covering seven subject areas: issues in higher education, managing the information resource, innovative technologies, office automation/networking, microcomputer issues and applications, promises and perils of technology, and applications. Also provided are five papers on different aspects of the information center in higher education and summaries of special interest sessions. Information is included on 14 company presentations as well as exhibits covering new information technology available to colleges. A paper based on Lloyd Vaughn Blankenship's keynote address, "An Amateur's View of the Information Revolution in Academe," is provided, and Edward T. Foote II's address on the importance of strategic planning in higher education is briefly noted. Topics covered by the other papers include: computer-related costs, evaluating computer center personnel, managing software development using the critical path method, selecting microcomputer network configurations, networking library and computer services, electronic mail, decision support systems for strategic planning, a statewide reporting system, and the use of new technologies at specific colleges. (SW)

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INFORMATION MANAGEMENT BASICS IN A NEW TECHNOLOGICAL ERA

Proceedings of the
1984 CAUSE National Conference

December 1984
Hyatt Orlando Hotel, Florida

U.S. DEPARTMENT OF EDUCATION
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CAUSE

CAUSE, the Professional Association for Computing and Information Technology in Higher Education, helps colleges and universities strengthen and improve their computing, communications, and information services. The association also helps individual members develop as professionals in the field of higher education computing and information technology.

Formerly known as the College and University Systems Exchange, CAUSE first organized as a volunteer association in 1962 and incorporated in 1971 with twenty-five charter member institutions. That same year the CAUSE National Office opened in Boulder, Colorado, with a professional staff to serve the membership. Today the association serves over 1,700 members on 700 campuses representing 480 colleges and universities and twenty sustaining member companies.

CAUSE provides member institutions with many services to increase the effectiveness of their computing environments, including: the Administrative Systems Query (ASQ) Service, which provides information from a data base of member institution profiles; the CAUSE Exchange Library, a clearinghouse for documents and systems made available by members through CAUSE; an Information Request Service to locate specific systems or information; consulting services to review the computing environment and management plans of member institutions; association publications, including a bi-monthly newsletter, a bi-monthly professional magazine, and the CAUSE monograph series; cooperative workshops with other higher education associations and member campuses; and the CAUSE National Conference.

We encourage you to use CAUSE to complement your individual efforts at strengthening your institution's management capabilities through the use of computing and information technology.

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INTRODUCTION

No one can accurately predict the impact of microcomputers, super data bases, or local area networks on higher education. Although this new technology challenges our management ability, we must not de-emphasize the importance of the basics—centralized data control, data security, data integrity, and data compatibility. These were the reasons behind the theme of the 1984 CAUSE National Conference: "Information Management Basics in a New Technological Era."

As managers of information processing at institutions of higher education, we are responsible for the strategic planning and the effective delivery of computer resources. The planning objectives are guided by the missions of our institutions, which are promoted by our chief executive officers. We were fortunate at the 1984 CAUSE National Conference to have two distinguished university executives as our general session speakers: Dr. Lloyd Vaughn Blankenship, Associate Chancellor for Planning and Resources Management at the University of Illinois at Chicago, and Dr. Edward T. Foote II, President of the University of Miami, Coral Gables, Florida.

The CAUSE84 theme was addressed through forty-nine presentations in seven subject tracks. Our speakers represented forty-one colleges and universities, from twenty-three states and Canada. The conference also offered informal sessions for the discussion of topics of special interest, and a Current Issues Forum which examined five different aspects of "The Information Center in Higher Education." Fourteen company presentations and company suite exhibits offered additional ways to explore the rapidly changing information technology available to colleges and universities.

The 1984 CAUSE National Conference provided an excellent forum for us to analyze the management issues that face today's information professionals in higher education. We hope these *Proceedings* will provide a continuing reference throughout the year to the many activities of the conference and of the association.

JACatrambone

Joseph A. Catrambone
CAUSE84 Chair

ACKNOWLEDGEMENTS

The success of the CAUSE National Conference is due entirely to the contributions of people and supporting organizations. Although it is impossible to identify all of those people who contributed time and effort to the planning and operation of CAUSE84, several individuals and organizations deserve special attention.

The CAUSE84 Program Committee spent many hours working with the CAUSE Staff to produce an effective and smoothly run conference. CAUSE gratefully acknowledges their enthusiasm, efforts, and the support of their institutions.

Jane Knight of the CAUSE Staff efficiently supervised the logistics of conference registration, both prior to and at CAUSE84. CAUSE appreciates the long hours she

1984 CAUSE NATIONAL CONFERENCE PROGRAM COMMITTEE

From left to right, row one—Deborah Smith, CAUSE; Jane Knight, CAUSE; Harry Grothjahn, University of Georgia; Constance Peckham, University of Arizona; Thomas Wilson, Loyola University of Chicago; row two—Julia Rudy, CAUSE; row three—Vice Chair M. Lewis Temares, University of Miami; Floyd Burnett, University of Alaska; Judith Leslie, Pima Community College; Joseph Catrambone, Loyola University of Chicago; row four—Charles Thomas, CAUSE; David Miller, New York City Technical College; Gary Devine, University of Colorado; Dana van Hoesen, CAUSE. Missing from the photo is Allan MacDougall, Southwestern College (California).

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logged behind the conference registration desk, as well as her helpful attitude. The assistance of Nikki Paczowski and Louise Delphus of the University of Miami at the CAUSE84 registration desk is also appreciated.

A special note of thanks is due Julia A. Rudy and Deborah K. Smith of the CAUSE Staff for their untiring and always professional efforts. From the advance preparation which began over a year before the conference through publication of these *Proceedings*, their special expertise and dedication contributed a great deal toward the success of the conference.

CAUSE also thanks the companies who set up Suite Exhibits and sponsored Refreshment Breaks, the Registration Reception, the Fun Run, and the Tennis Tournament, and those who gave company presentations and provided an evening of hospitality in their suites.

1984 CAUSE BOARD OF DIRECTORS

From left to right, row one—Dorothy Hopkin, Michigan State University; Kathlyn Doty, Loyola University of Chicago; Sandra Dennhardt, University of Illinois/Central Office; John Monnier, University of Arizona; row two—A. Wayne Donald, Virginia Tech; W. Mack Usher, Oklahoma State University; Charles Naginey, Pennsylvania State University; row three—James Strom, California Polytechnic State University; Martin Solomon, Ohio State University; James Penrod, University of Maryland/Baltimore; Charles Thomas, CAUSE.

The continuing support of the CAUSE Board of Directors and the membership they represent is also gratefully acknowledged and appreciated. Retiring from the 1984 CAUSE Board were A. Wayne Donald, Virginia Tech; James L. Strom, California Polytechnic State University; and Dorothy J. Hopkin, Michigan State University. CAUSE members elected to three-year terms on the Board of Directors beginning in 1985 were: Cedric S. Bennett, Stanford University; Judith W. Leslie, Pima Community College; and Wayne O. Ostendorf, Iowa State University.

Retiring Board members (left to right) Jim Strom, Wayne Donald, and Dorothy Hopkin will be missed.

Dennis Berry receives his certificate

The association is supported by five CAUSE Member Committees which are increasingly creative and active. CAUSE appreciates the contribution of time and effort made by the volunteers who carry out the duties of these committees. At the first-day luncheon at CAUSE84, Vice President John A. Monnier expressed appreciation to many such individuals. For their service in 1984 on the CAUSE Election Committee: Dennis Berry (Chair), University of Colorado; Joseph P. Balabon, Mercer County Community College; Floyd R. Crosby, West Virginia University; Bill N. Hale, Texas Tech University; and Richard West, University of California/Berkeley. For their service on the Recognition Committee: Robert L. Clark, University of Tennessee and Jon Mosser, California State University/Dominguez Hills. For his service on the Current Issues Committee: Thomas W. West, California State University System. There were no retirements from the Editorial Committee, as a result of the expansion of this committee from six to twelve members in 1985. The members of the CAUSE National Conference Program Committee were specially recognized by CAUSE84 Chair Joseph A. Catrambone.

KEYNOTE ADDRESS

AN AMATEUR'S VIEW OF THE INFORMATION REVOLUTION IN ACADEME

Lloyd Vaughn Blankenship
Associate Chancellor for
Planning and Resources Management
University of Illinois at Chicago

KEYNOTE ADDRESS

Dr. Lloyd Vaughn Blankenship, Associate Chancellor for Planning and Resources Management, University of Illinois at Chicago, delivered a thought-provoking keynote address which discussed the impact that new technological innovations will have on all traditional functions of the university—teaching, research, and public service. Dr. Blankenship also examined some of the policy and organizational issues involved in administrators' use of these technologies, and addressed the use of technology to support the internal administrative, planning, and decision-making activities of academic institutions. A paper based on this keynote address follows.

Dr. Blankenship, CAUSE84 Chair Joseph A. Catrambone, and Mrs. Catrambone

GENERAL SESSIONS

CAUSE84 was highlighted by several general sessions which brought conferees together to hear presentations and share in activities of general interest. The conference opened with an orientation session, which included information about CAUSE as an association as well as helpful hints on how to "cover" CAUSE84. This session was immediately followed by the CAUSE Annual Business Meeting, which included an entertaining and informative color-graphics slide presentation called, "CAUSE Today and Tomorrow." Two distinguished university executives presented general-session addresses at CAUSE84 (see pages 7 and 17). The CAUSE Board of Directors, Member Committees, and recipients of CAUSE awards were honored at luncheons during the conference (see pages 18 and 19). The final general session of CAUSE84 was a Current Issues Forum on the subject of "The Information Center in Higher Education" (see page 20).

A few years ago, a well-known study concluded that the United States had become an "information society." In the past hundred years we have moved from a farming, to a heavy industry/blue collar, to an information economy. Direct and indirect information activities now account for over 46% of our GNP; over 60% of income is earned by information workers. Since this study, the breathtaking rate of technological innovation in information systems and the decline in the cost of computing power has continued to transform our society and the way we do things.

Our academic institutions are an integral part of this "information society." Much of the knowledge base upon which our information technology and software rests, was developed in universities or by individuals who were trained in universities. Many of the people who presently use this technology in our banks, schools, businesses, and public agencies received their introductory training in academic institutions. Under such circumstances, it seems a bit ironic that these same academic institutions have an uneven record for exploiting the capabilities of this technology for their own institutional purposes.

The new wave of technological innovations--micro-processors, high speed local and satellite digital computers, so-called "super" computers, video disc and other information storage devices, two-way cable systems, and robotics--will have an impact upon all of the traditional functions of the university: the education of people; the production of new knowledge--about information technologies as well as other matters; and the performance of public service activities. I think it is safe to assume that these impacts will be uneven, more in some functional areas than others, more in some academic institutions than others. They will also occur in an environment of financial stringency and radically changing student demography.

I would make several other general observations. The academic institutions which receive, or adapt, these new technologies are not tabula rosa--blank pages upon which these innovations make their mark. An archaeological "dig" might be a more appropriate analogy.

Computers, telephones, cable, office automation equipment and terminals, have been around, in one form or another, since the late 1950s. Each new wave of technology, each significant--or not so significant--innovation has been laid along side of or on top of the pre-existing ones. Thus, if we were to cut a slice from the "information environment" of a university and examine the revealed strata like an archaeologist, we would find mechanical shards, bits of software, old skills, and, most importantly, the dinosaur bones of a wide variety of human organizational structures from each technological era. This is important to understand because it means that each new wave competes with existing systems for resources, skills, attention, and new modes of organization, new attitudes. It is a Darwinian World!

A second general observation is that the producers and purveyors of these new technologies are driven by economic motives--sell, get a bigger share of the market, position yourself to get an even larger share in the future. This attitude isn't "bad", it's just the business ethic. How a particular technology impacts the internal structure or function of the university--as any other institution--is at best an abstract concern, except as it might give rise to new products or new selling opportunities.

Arrayed against this ethic of the "hard sell" is an institution-- the university--composed of highly diverse intellectual and social cultures and styles and characterized, generally, by fragmentation, decentralization, decision-making by committee, and, at least in some quarters, fascination with new technologies. Given this institutional character, it is difficult to see how one might plan for and manage the introduction of new technologies in a more systematic, comprehensive manner than in the past. The problem of planning is made doubly challenging because new and better products are constantly emerging, prices are continually dropping, or changing, and ever newer, more cost effective systems are continually promised.

In the balance of my talk, I would like to address each of the functional areas of university activity--teaching, research and public service--and make a few observations about the impact of emerging information technologies upon each of them. I also intend to comment on some of the policy and organizational issues involved in the administrators' use of information technologies.

In some sense, as the title of my address indicates, my views are those of an amateur. I only recently returned to a university after an absence of about 12 years. I have never been the manager of an "information system" in the sense that the term is used in this conference. In another sense, however, I can claim a bit of "expertise" on the subject of "information systems." As Director of the Office of Budgeting and Programming and Budget Officer at the National Science Foundation, I was responsible for putting together, helping to defend, and managing an important "information system": an agency's budget. Much of this work was facilitated by computerized data bases and office automation.

In this same role, I participated in policy and budgetary discussions of such things as the new super computer program at NSF, and research funding activities in computer research and computer engineering. In an earlier NSF role, I had an oversight responsibility for the robotics and telecommunications research programs and also frequently participated in reviews of the Foundations' computer assisted instruction activities in science education. In each of these ways, I saw or directly experienced a "piece" of information technology and its potential impact on academic institutions. This certainly justifies some claim to expertise.

Education and Teaching

There are multiple dimensions to the relationship between the universities' educational role and the emergent informational technologies we have been discussing. First, the university is the primary producer of individuals to meet the demand for computer specialists in both the private and public sectors of the economy. Secondly, its educational and research functions are linked in its graduate educational role. This helps insure that the next generation of faculty and trained scientists and research engineers are kept at the leading edge of technical and scientific developments in these rapidly changing fields. Finally, the university employs informational technology, in different modes, as an integral part of the educational process itself. Let us examine each of these in a bit more detail.

In the past few years, the "information revolution" has created an explosive demand for computer specialists in the economy. Recent projections (February, 1983, NSF) indicate that employment in these specialties will grow at an annual rate of almost 6 percent for the next five years. In spite of this growth, by 1987, there is a projected supply shortfall ranging from 15 to 30 percent. This translates into a possible need for 114,000 to 140,000 additional personnel by that year.

These market conditions have impacted on academic institutions in several ways. Enrollments in undergraduate computer science courses and in closely related fields of engineering have shot up, doubling and tripling on many campuses. Classrooms have filled, facilities have been over-scheduled and over-utilized, and it has proved difficult, in the short run, to provide sufficient faculty to meet the burgeoning demand, especially since they are also doing research in some of the "hottest" technical fields going. So we hear more and more talk of "faculty shortages" in certain critical areas.

These developments have led to the reallocation of resources within the university, sometimes pitting the engineering, science, and business school faculties against the humanists or less favored professional schools and fields of science. This is always a slow, painful process, but most especially in a period of financial stringency.

These same market conditions have greatly increased the industrial demand for trained graduate students and Ph.D researchers in computer science, mathematics, and electrical and computer engineering. This has put universities in head-to-head competition for such individuals with private industry, whose salaries and in many instances, research facilities are perceived to be much better than those presently available in academic institutions.

Since these are the same individuals who will provide the next generation of faculty to produce new scientific and technical knowledge and train additional undergraduates in computer specialties, this situation has led to a national concern that we may be using up what more than one commentator has called our "seed corn". Consequently, a variety of academic, scientific, political and even industrial spokesmen have pushed for programs to improve academic research facilities in computer science and engineering and to increase the attractiveness of an academic career in these fields.

These programs are, of course, mixed blessings to academic institutions because they result in further differentials among faculty on the same campus, and even in the same departments. It is also the case that universities have to come up with "matching funds" to build--or remodel--and operate the "bricks and mortar" to house these research facilities. And as any of us associated with universities in the last few years know, these can be the most scarce dollars of all.

The use of informational technology, especially computers, in the educational process itself has, I believe, gone through two primary phases in the last two decades. One of these phases was the use of the computer as a "black box", to deliver a complete, pre-programmed course of instructions to the student through a terminal hooked up to a mainframe computer.

The best known of these--PLATO--was initially developed by my present institution, the University of Illinois, under a grant from the National Science Foundation. As an amateur, my general impression is that, after 20 years of development, this mode of instruction has proven to be cost effective in only a limited number of settings under a restricted set of conditions. It has proven particularly useful in such things as the training of Reactor Safety Engineers where one needs a careful accounting record of "errors" by trainees and in industrial training programs where the material is more focused and vocational than in the typical classroom, and where industry is already paying the salaries of students. Its educational value, relative to its cost, has apparently been more limited in more traditional educational settings.

The second phase has been the use of the computer as a tool in the educational process. The emergence of the relatively low-cost personal computer is the most recent, and exciting, version of this mode of institutional use of the computer. Not only does the "PC" serve as a calculator or low-cost, highly efficient "word-processor", but there is some evidence that it has the potential for changing how calculus, discrete mathematics and writing are taught or applied in the classroom. Remedial calculus has one of the highest course loads on any college campus. The micro-processor may obviate the need for such courses or the need to teach mathematics sequentially. All of us who have ever written anything know that 75 percent of the effort goes into making revisions. By making revisions easy, word processing programs will allow students in such fields as English, history, and sociology to concentrate on the substance of their ideas. These programs will also make them good spellers and grammarians!

In my judgment, however, it is much too soon to know how cost-effective these new tools will be in the total learning process or just what impact they will have on teaching. My guess is that they are being adopted as a tool by some universities without any re-thinking of teaching strategies or curricula.

The Research Function

Research--basic and applied--is the next functional area of activity I would like to touch upon this morning and, like the educational role, it has a multiple relationship with the "information revolution" in academic institutions. I have already mentioned one of these in my earlier comments on graduate education. Now let me address two others.

The breadth of research related to information technology and software being conducted today in our universities is impressive. It underpins the most dynamic sectors of our economy--communication, micro-electronics, and computing. Though these industries conduct a substantial amount of R & D themselves, their work relies heavily on much of the basic academic work and, most importantly, the graduate products of this work.

From a public policy and institutional perspective, one of the most interesting developments of the last four or five years is the growing interest in, and emphasis on, "industry-university relationships". The basic and applied research underpinning "information technology" has proven to be a natural, and exciting, focal point for the emergence of these new "relationships".

On the academic side, there is the need to obtain additional resources--in a period of financial stringency. Research in these fields tends to be expensive because there is a continual need to upgrade the quality of existing instrumentation and purchase new equipment to remain at the cutting edge of work. It also gives faculty, and graduate students, access to the latest developments in highly technical, rapidly changing industries. On the industrial side, there is a recognition that a firm's ability to maintain its competitive advantage through producing new, or improved, products, depends very much on R & D.

The concrete forms of "industry-university" relations which have emerged in these technical areas are among the most dynamic developments taking place on many campuses. They range from the use of public funds to establish "high tech" industrial parks near the university to such things as joint industry/university research centers, industrial gifts of hardware or software, or the kind of association between universities and a firm represented by the comprehensive agreement between Carnegie-Mellon University and IBM. For business firms, these relationships provide access to the latest research as well as to faculty and students. It is also likely that what they learn from the use of their systems in an educational and advanced research environment may be turned into product improvements or new commercial markets.

Now let me switch from research on information technology to the use of information technology in research. During the late 1950s and throughout the 1960s, computers were established on most university campuses as a new research tool. This was the period of the large, centralized computing facility, supported initially by government funding and, subsequently, by institutional funds and staffed by programmers and systems analysts who were supposed to help researchers use it in an efficient way. Virtually every discipline on campus--from engineering and physics to history, drama and architecture--used the computers in some or all of its research.

In the late 1960s throughout the 1970s, there were a number of critical developments--some technical, some institutional or financial--which began to change the relationship of researchers, and others, to the central campus computing facility. To begin with, computers became an integral part of increasingly sophisticated communications systems. Remote access, time sharing, and interactive systems permitted users who were physically remote from the computer to make use of them.

An investigator no longer had to be physically present at a center, or even on a campus, to carry out research. As computers became more and more accessible to users through communications networks, the problem of "computer security" became a major challenge, not only on the campus, but in businesses, government laboratories and agencies like the Department of Defense.

Two organizational developments in the "information economy" will probably have profound implications for academic institutions and their use of information technology in all of these functions, including research. The telecommunications and computing industries are merging as the result of economic pressures and the technological developments I have been describing. The heart of the telecommunications network is now a computer--an electronic switch--while the usefulness of data processing facilities and services is increasingly a function of their accessibility through a communication network.

The breakup of the telephone industry and its changing economics could mean that an increasing number of universities will get into the business of buying and servicing their own telecommunications systems, including optical fiber cables linking them with other research and educational centers. Obtaining the resources to finance such potentially exciting and cost-effective developments will be a problem for most academic institutions unless they get support from the Federal government or the telecommunications industry itself.

There were a number of other important technological developments in the 1970s besides those in communications which changed the relation of the researcher to the central computing facility. Primary among these developments was the appearance of micro-computers, VAXs and array processors which made it technically possible for academic departments or even individual research groups to acquire their own computational centers. This move towards decentralization was greatly facilitated by two other organizational factors: the perception, in many institutions, that the campus computer centers were adopting operating policies favoring administration and education over research and the general refusal of Federal R & D agencies to support the full cost of computer time in their research grants.

From a research point of view, one of the most exciting developments in recent years is the National Science Foundation, an experimental computer research facilities program. Concerned about the deterioration of experimental computer facilities on the campus and the growing use of existing centers for administrative purposes, the Foundation initiated a multi-year, multi-institutional funding program in FY1980 to provide support for systems development, maintenance, operating costs and technical and professional support personnel for computer research.

The Foundation has also developed plans for an ambitious program to increase academic accessibility to so-called "super computers" for scientific and engineering research. Until now, the unit cost of organizing and operating super computers facilities has been too high to accumulate these costs through charge backs to individual research grants. Consequently, their major use as research tools has been restricted to Federal laboratories where costs can be concentrated and the research focused on a limited set of problems and disciplines. Because so relatively few academic researchers have had access to these machines, few have developed the skills, understanding, and research interests required to work effectively on them.

Recognizing the "chicken and egg" character of this problem, the Foundation has proposed a program of broad-based, multi-year, multidisciplinary support for research using the super computer. In the long run, this is the only way to increase the critical mass of investigators to a sufficient size to make these facilities economically viable.

Eventually, as many as 10-20 new super computing facilities may be supported on university campuses across the country. The establishment of these facilities will, of course, parallel the support for improving networking and the local research environment. There is no doubt that this is a complex, exciting program which will take a number of years, and multi-million dollar funding, to implement fully. There is also no doubt that it will profoundly affect the computing and telecommunications environments of many academic institutions--even those which are not the recipients of a large-scale facility--and change the character and quality of computer-related research which can be done in virtually every field of learning.

Public Service

The third functional area of interest in academic institutions, that of public service, is an outgrowth of the Morrill Land Grant Act of 1865. In general it has been manifested through various "extension services" in our large state universities. It is a difficult concept to understand. As one University of California Dean of Extension Services was quoted:

> "...the discussions (of public service) reminded
> me of arguments about the nature of the Holy Ghost
> in that other Sacred Trinity. Everybody is convinced
> it is important, but nobody is quite sure what it is."

My impression as an amateur is that the most significant potential impact of the information revolution on the public service function of academic institutions lies in the remote delivery of education, and other informational services, to individuals and groups lying off the university campus. There are a number of demographic and organizational factors which make me believe that there may be a growing opportunity for such services.

It is a generally accepted fact, for example, that over the next 10-15 years, there will be a decrease in the traditional college-age population, both in numbers and as a proportion of the total, with a concommitant increase in the number and proportion of those "over sixty." If these projections hold, many academic institutions may have to shift their educational activities towards new markets--both geographically and demographically--in order to protect their financial and educational base.

Because of the developments I have already described, there is no doubt that the technology is already available and, indeed, some academic institutions have established networks for the remote delivery of educational and other information services.

My sense, however, is that several things have inhibited widespread development and use of this technology for these purposes by academic institutions. To begin with, resources are scarce and this activity has to compete against the higher priority research and traditional on-campus educational activities. It also competes against offerings available in some markets on commercial cable. Secondly, there are an array of unresolved technical and organizational issues. Who, for example, will control scheduling and content? How will it relate to other campus functions? Thirdly, there are important pedagogical and learning issues to be resolved. How effective and satisfying is the learning experience in a remote environment, even with two-way voice and video communication? In the early 1970s there were those who were predicting great things from the delivery of a variety of informational services via cable networks. I have the feeling that most of these have not panned out or at least lived up to the glowing expectations of their proponents.

The most fundamental difficulty in an academic setting is probably the ambivalence of faculty and administrators toward "public service" activities. They are not generally regarded as part of the "mainstream" of academic values and concerns.

Administration and Policy-Making

Let me turn, finally, to the impact of the information revolution on the use of technology to support the internal administrative, planning, and decision-making activities of academic institutions themselves. Several studies I have recently read have pointed with alarm to two developments: (1) expenditures on administrative applications have been rising faster than for educational and research applications; and (2) administrative expenditures now constitute 50 percent or more of all academic expenditures for computing and, I assume, for telecommunications. In my view, these trends are quite understandable.

First of all, Federal support for computers in education and research declined after the mid-1960s, though the initiatives by the National Science Foundation which I described earlier may produce a partial reversal of this trend. Secondly, I suspect that administrative applications for such things as payroll, personnel files, accounting, grants management, and student admissions and records offered the greatest opportunity for productivity improvement and increased efficiency. Consequently, in tight operating budgets, the users of such applications could point to assumed savings which would cover at least part of the cost of their development and implementation. Thirdly, the constant demand of the Federal government, in particular, for institutional accountability and more and more information on everything necessitated improvements in administrative record-keeping and reporting. Finally, administrators rather than faculty came to dominate the central computing facility in a number of institutions for some of these same reasons. This put them in a favored position to set policies on access, scheduling and resource allocation.

An academic institution is in a classic "make or buy" situation when it decides on whether or not to develop--or improve--an administrative application. Whether the decision is to "make or buy", it is quite likely, for a number of reasons, to be more complex, take longer, and cost more than anybody initially anticipates.

To begin with, the committee/consensus style of academic decision-making and the general fragmentation of responsibility leads to over expectations on the part of users and over-promises on the part of developers, whether commercial or in-house. Neither is such a management and funding environment conducive to the kind of stable, dedicated project management which is most effective for long-term system development and application. Commercial vendors suffer from similar problems--changing markets and economic conditions; turnover in skilled personnel; and shifting management priorities. Thus, the "make or buy" decision is a bit of a Hobson's Choice!

In spite of these problems, however, it is my impression that the people whom I shall call functional managers--Registrars; Directors of Admission and Records; Director of Physical Plant; Directors of Business Affairs or of Grants and Contracts--are generally better off, in terms of administrative applications of information technology than are middle and higher-level general academic managers and policy makers. The needs of this latter group for timely, reliable information on internal resource conditions and performance or on external environmental developments of strategic importance has been generally ignored, up until now, in the focus on functional activities.

Functional activities are probably much easier to identify and specify than are the more nebulous, intellectual needs for better integrative information for strategic planning; decision-making and resources management.

I believe our greatest need for innovation and creativity lies in the development of effective decision-support information systems for department chairmen, Deans, and higher level academic officers. One of my last acts at NSF was to prepare an RFP for designing what I called a decision-support and budgeting information system for the Foundation. The challenge is not unique to academic institutions. While I was writing the RFP, I had several conversations with my counterparts at the Department of Energy and NASA. Neither of these technological agencies had developed such a system, though both were beginning to consider them. I am pleased to see that one of the other speakers on your program will be explicitly addressing information requirements for strategic planning and management in universities.

Conclusion

There seems little doubt that now, and for the forseeable future, information technologies present a challenge, and an opportunity, to academic institutions in all of their traditional functions. The rates of technological and economic change in our communications, micro-electronics and computing industries are explosive and the university is affected by and affecting these changes in an astonishing number of ways.

It is very tempting to offer academic institutions a counsel of perfection: plan rationally, manage better. None of us can be against these commandments. All of us will try to follow them; a small number of us might actually succeed in doing so! The problem is that academic institutions are "open systems." Because of their decentralized open character, change is disjointed, gradual, slow, difficult to direct from any central point.

I recently had occasion to visit a number of universities in different parts of the country and inquire about how they were organized to manage their information activities. Several things intrigued me. It was not clear how--or if--computing for educational and research purposes, computing for administrative purposes, telecommunications, and office automation, were related, organizationally or budgetarily. Some campuses had two separate computing facilities for research and administration with two directors. Others had only one facility or had combined two under a Vice Chancellor or a Vice President or a Vice Provost for Computing. At no time did I have the feeling that any particular organizational arrangement had reached an equilibrium state.

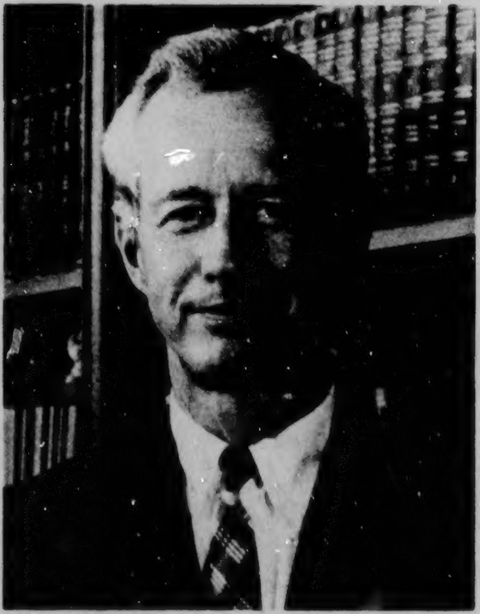
It was also not clear how effective any planning or management strategies for informational technologies can be if they are considered independently of the way in which we do business. While we are asking, for example, how to employ "personal computers" to facilitate education or administration, we need to be asking whether we need to change how we teach or how we administer. It is, truly, a "whole systems problem", not just a problem in technological applications.

This is finally, what I think a friend and former colleage of mine, C. West Churchman meant by the "paradox of system improvement." You really can't be sure whether or not you have really improved things until you have looked at, and understood, the largest possible, whole system. For now, I would be satisfied if we merely understand the "whole system" of the university better. Then, perhaps, we will understand better all of the challenges and opportunities of the "information revolution" including technological and how to make certain they work to our advantage in achieving our multiple academic objectives.

STRATEGIC PLANNING IN HIGHER EDUCATION

THURSDAY MORNING ADDRESS

Featured speaker Edward T. Foote II, President of the University of Miami, provided stimulating views on the importance of strategic planning in higher education. Dr. Foote discussed the process used to complete a strategic plan at the University of Miami after two years of work, as well as the importance of accurate information to the success of such a planning process. His address assessed the strengths and pitfalls of strategic planning as a systematic basis for decision making in higher education, with emphasis on planning needs for information, and some suggestions for the future.



Edward T. Foote II
President
University of Miami

Lewis Temares and President Foote

CONFERENCE LUNCHEONS

At the first-day luncheon, members of the CAUSE84 Program Committee and Registration Staff received gifts of appreciation for their contribution to the conference, and retiring members of CAUSE Member Committees were awarded certificates of appreciation. Newly elected CAUSE Board members were announced, and retiring Board members received certificates and were acknowledged for their service to the association. At the Awards Luncheon, held on the second day, 1985 CAUSE Officers were announced and the CAUSE Recognition Awards and the *CAUSE/EFFECT* Contributor of the Year Award were presented.

Outgoing CAUSE President Charles H. Naginey (left) presents the gavel to newly-elected President John A. Monnier

1985 CAUSE President John Monnier (right) presents outgoing President Charles Naginey the CAUSE President's Plaque

1985 CAUSE Officers, Secretary/Treasurer Sandra Dennhardt, Vice President James Penrod

New Board members, left to right: Wayne Ostendorf, Cedric Bennett, Judith Leslie

AWARDS

James L. Morgan (center) of the State University System of Florida received the 1984 CAUSE Award for Exemplary Leadership for his advocacy and support of administrative information systems in higher education both at the SUS of Florida and at the national level. John Robinson (right) represented Information Associates, sponsor of the Recognition Awards, at the presentation, which was made by CAUSE President Charles Naginey (left).

Wayne O. Ostendorf (center) of Iowa State University received the 1984 CAUSE Award for Professional Excellence in the field of administrative information systems in higher education for his accomplishments at both ISU and at the national level. John Robinson (right) represented Information Associates, sponsor of the Recognition Awards, at the presentation, which was made by CAUSE President Charles Naginey (left).

The 1984 CAUSE/EFFECT *Contributor of the Year Award was presented to Charles H. Nicholas, Microcomputer Coordinator in the Office of Information Systems at the University of Kansas, for the contribution of a feature article judged to be the most outstanding of all contributed papers published in the 1984 volume of the magazine: "Planning Microcomputer Information Services: The Institutional Research Role"* (CAUSE/EFFECT, *November 1984, pp. 4-10). Mr. Nicholas (center) accepted the award on behalf of his co-authors Barbara Paschke and Terry Harer, who were unable to attend CAUSE84. William Lukens (right) represented Systems & Computer Technology Corporation, sponsor of the award, at the presentation, which was made by CAUSE President Charles Naginey (left).*

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CURRENT ISSUES FORUM

THE INFORMATION CENTER IN HIGHER EDUCATION

Forum Moderator Tom West

FRIDAY CLOSING SESSION

The conference closed with a forum on a topic of increasing interest in higher education today. The Information Center is emerging as one solution to the problem of increased user demands for decision support information and new applications. Successful implementation of an Information Center benefits the Management Information Systems organization, the users, and the institution as a whole, but careful thought and planning are necessary for success. How can the Information Center concept be integrated into the higher education environment?

The Current Issues Forum at CAUSE84 consisted of a panel moderated by Thomas W. West of the California State University System. The five panel members—Ronald W. Jonas, Indiana University; Bernard W. Gleason, Boston College; Sharon P. Hamilton, San Francisco State University; Phyllis A. Sholtys, Northern Kentucky University; and Steve Fletcher, Arizona State University—each gave a presentation on a different aspect of the topic. Papers based on their presentations follow in this section.

Ronald Jonas
Indiana University

Phyllis Sholtys
Northern Kentucky University

THE INFORMATION CENTER AS AN AGENT OF INSTITUTIONAL CHANGE

Ronald W. Jonas
Indiana University
Bloomington, Indiana

ABSTRACT

At Indiana University, we are using the Information Center to carry computing service beyond the point where success is measured by the number of systems provided and the amount of computing power available. We are working toward a style of customer service in which success is measured by our ability to coordinate the activities of users, to communicate, to educate, and to support institutional policies concerning the appropriate use of information. This paper traces our long pursuit of the Information Center, the evolution of our systems and strategies, and the impact of this new service on the University at large. The case is made that the Information Center, in its fullest form, is acting as an agent of change causing organizational integration and the appropriate application of personnel and financial resources.

Indiana University has been pursuing the dream of the Information Center for many years — long before the term entered our vocabulary. In the early 1970s, the institution installed a non-procedural programming language to facilitate data retrieval and reporting and acquired a database management system to provide a mechanism for making strategic data available to support management decision making. These early efforts were successful not in and of themselves but because they set the stage for an evolutionary process which led to the Information Center we have today.

As a matter of fact, the database management system proved to be problematic. After a student information system was created and placed in service, we began to realize that the University's computer hardware was inadequate to support a full-scale database approach to on-line data maintenance and reporting. The "natural language" retrieval feature which was such an important factor in the selection of the database management system never had an opportunity to perform. It was quickly relegated to night shift processing because it degraded the performance of the on-line terminal network during the day. Its fate on the night shift was not much better because it degraded the performance of batch processing activities.

Before long, the natural language feature of the database management system fell into disuse. Because of these problems, more and more dependence was placed on the non-procedural language to do data retrieval and reporting. This language could not be used against the database because it had been designed for accessing flat files. This was not a problem initially, because the institution was still maintaining a flat-file version of the student information system for other reasons. In time, though, events conspired against this retrieval language too.

Five years ago, we came to the conclusion that we could no longer afford to develop new systems with the database management system.

Having reached that conclusion, we initiated a plan to diminish and eventually eliminate the use of the database system. This permanently doomed the use of the "natural language" retrieval feature. Ultimately, it also doomed the flat-file version of the student information system from which the non-procedural language could provide its services. These changes, coupled with the anachronism of a batch-oriented non-procedural language in an increasingly on-line environment, signaled the need for a new approach to providing the strategic data necessary for decision support of the University's management. What we did not suspect at the time was that it was going to lead to sweeping change in the University.

As we look back, the implications should have been clear to us Our decision to abandon the database management system as the foundation for our information processing had, by definition, to result in a new way of doing business. By this time, many other computing needs were also demanding attention. Robert Peterson noted in a recent issue of Computerworld that "we are now being driven into a new age by our customers who are no longer content to wait for us to understand the issues facing the organization." He argued that this forced transition will reach to the heart of how we conduct our business and how we support our customers. Recognizing these forces in our own institution several years ago, we felt an urgent need to concentrate on customer service. Accordingly, about four years ago we set the following primary objectives for ourselves:

Improve on-line performance
Extend on-line processing hours
Extend batch processing hours
Improve ad hoc retrieval services
Give priority to developing on-line updates
Reduce the cost of developing programs

We realized, however, that we would not be able to pursue these goals without addressing some related processes, so we set a secondary set of objectives for ourselves:

Improve integrity of information in data bases
Preserve and increase the security of data bases
Increase user awareness of available services
Reduce organizational resistance to change

In the process of addressing these goals, we created an Information Center which has become the vehicle for an entirely new approach to computing. By constructing this new environment, we have accomplished many of the objectives that we set for ourselves. The characteristics of our new style of computing include:

Two Separate Environments
  CICS for data maintenance and display
  FOCUS/TSO for data analysis and reporting

Division of Labor
  Computing staff programs CICS functions
  Customers use FOCUS for information processing

Master data bases only accessed by CICS

On-line processing hours longer

Batch processing hours shorter

Information Center available all hours of the day

While it is common for people to speak of the changes which the Information Center makes in the user community, we have found that it can bring equally profound change to the staff and to the structure of the data processing department itself. We are using the Information Center to carry computing service beyond the point where success is measured by the number of systems provided and the amount of computing power available. We are working toward a style of customer service in which success is measured by our ability to coordinate the activities of users, to communicate, to educate, and to support institutional policies for the appropriate use of information.

We think there is a larger role which customers can play in the development and utilization of computing services, and we are using the Information Center to define and extend that role. All of the new systems which we have developed in the last year or two have offered the users the opportunity to design and develop both regular and ad hoc reports. By delivering batch processing through the Information Center, we have been able to reduce conventional batch processing and to extend the on-line services under CICS. The Information Center, existing as a separate environment, is available around the clock.

The central characteristic of our new approach to computing is separate but linked storage for the CICS network and the Information Center. It is no longer clear when the idea first occurred to us, but early in the process we considered and adopted the approach of replicating the CICS master file data for the Information Center. Once we considered and committed to the cost of additional storage to drive an Information Center, there was no turning back. The decision to replicate data for the Information Center was not arrived at easily or lightly. Once decided, though, it opened the way for us to achieve a number of things for the institution which we had not planned. Thus, the Information Center has made the following changes possible:

Two environments can be served by one or two computers
Master files can be recovered rapidly
Data structures can be changed as needed
All batch reporting can be transferred to the Information Center
Non-technical users can do all batch reporting

Two or three years after we embarked on this course, we found ourselves in a position to solve the problem of insufficient computer hardware by acquiring a second large computer. By this time, though, the impetus for an Information Center was so strong that we chose not to change course. The opportunities for institutional change were enormous, and we wanted to take advantage of them.

We continue to be pleased with the benefits of these two separate environments we have created. Because of their separate but related nature, we are able to use files in these two environments for high-speed back-up and recovery and for staged management of storage. Because of the way we have designed the Information Center, we are able to change and add data elements as needed without adversely affecting the work of our users. New insights continue to occur, and they are changing computing services for the institution in a very beneficial way.

The high point of the institutional change we are experiencing is the totality with which the user community is becoming involved in the delivery of its own services. Now the clerical staff of the University as well as the professional staff is making practical use of the institution's data on a daily basis. Users are no longer waiting for computing or other support staff of the University to write programs for data analyses and reports. The institution no longer has to invest in high-cost technical training or even higher-cost salaries to perform these services.

The Information Center has transformed data retrieval and reporting from a slow process performed by high-priced technical personnel to an instantaneous service performed by those who need and can define the service required. The enterprise has been so successful that we now believe it is possible to transfer all established, conventional batch reporting to the Information Center. Once this is accomplished, we will have reduced traditional night shift batch processing to a small and manageable size. Our next objective will be to redesign older systems to eliminate this type of processing altogether.

As our ideas have progressed from those original needs to solve performance problems and to provide users with ad hoc retrieval tools into the concept of full user support, our Information Center has evolved to provide an equal business partnership between the user community and the computing staff. In its fullest form, it is causing organizational integration and the appropriate application of personnel and financial resources.

The Information Center at Indiana University has truly been an agent of change — affecting the lives of the users of computing as well as the lives of the computing staff. The result has been not only a change in the style of computing but also an improvement in the quality of computing for the institution. This is far more than we expected when we began our quest several years ago for an Information Center.

INFORMATION CENTER
BRIDGE TO END USER COMPUTING

Joanne Brennan
Christopher Dimock
Bernard W. Gleason, Jr.

Boston College
Office of Management Information Systems
Chestnut Hill
Massachusetts

The goal of end-user computing is to allow individuals (users) to access and manipulate data with a minimum of M.I.S. intervention. M.I.S. will, ideally, act as a system administrator and a source of help and expertise and the role of the Information Center is to provide the bridge between M.I.S. and the end-user. The result will be an integrated information processing architecture -- integrating both structured and unstructured applications, host-based and local processing -- in the most economic, efficient, and responsive manner. This paper provides an overview of the strategy for implementing the 'Information Center concept' at Boston College.

A. INTRODUCTORY REMARKS

The topic of the presentation is the "Information Center". Prior to getting into an explanation of the Information Center, it is appropriate to say a few words about the philosophy behind administrative computing at Boston College and then to explain how the Information Center fits into the total picture.

You frequently hear the term 'end-user computing'. I'd like to coin a new term that is an extension of the concept and call it 'end-end-user computing'. In data processing and user departments we have for a long time been guilty of designing systems and procedures to improve the efficiency of the office, or establish stricter controls, or produce niftier results, or quicker access to data bases, and so on. In most instances the 'end-users' are the user departments (i.e., Registrar, Controller, Development, etc.).

The term 'end-end-user' is used to identify the true users of systems and point out the weakness in current systems. In a Student Record System the real end-user is the student and not the registrar and the design of a registration system should focus primarily on service to the user (student). In that sense, the first order of concern should be in providing facilities that will allow students to search course selections and register themselves. In a payroll system, the 'end-user' is the employee and not the payroll, budget or personnel departments. The system should be responsive to employee needs (i.e., accommodating extended benefits, timely processing of payrolls, etc.). Another example is a Purchasing/Budgeting/ Accounts Payable system where the end-user (departmental manager) must be able to manipulate budgets, initiate orders, and track status from their office and without the current archaic paperwork flow.

If you are asking the question, "What does this have to do with the Information Center?" the response is simply that M.I.S.'s commitment to end-user computing extends not only to local processing, but also across the design of all major systems. The notion is important to understand so that the user community does not automatically assign attributes such as unaccessible, rigid, out-dated, etc. with the production systems and looks only to local processing as the only solution to special information needs.

In most data processing organizations the typical model that is evolving is composed of three components: Development Center, Production Center, and Information Center. The Development Center refers to the personnel and tools required to support the traditional data processing services (i.e., designing, implementing and maintaining host systems). The Production Center is the actual computing facilities and support personnel such as systems programmers, operators, and production controllers. At Boston College, this function is located in Computing Services. The third fastest growing area is the Information Center. The term 'Information Center' is a bit misleading in that it seems to imply a separate new sub-department or a whole new set of products. In actuality, it is really a set of services, and it could be more appropriately called 'Information Services'.

If we accept the Development and Production Centers as servicing the traditional data processing requirements, then the Information Center is everything else. For many years the administrative computing environment has been structured and all the service functions have been performed internally within M.I.S. and Computing Services. In the academic area, where historically computing has been the responsibility of the end-user, Computing Services has had to provide user services to assist and coordinate the activities of these varied users. With the move in the administrative area toward more distributed computing and processing, the same type of service will be required. It is the responsibility of the Information Center to provide the bridge between the production environment and the end-user by providing specialty services and centralized coordination and control.

The goal of Information Services is to be more responsive to user information needs by designing, implementing and supporting an integrated information processing architecture -- integrating both structured and unstructured applications, host-based and local processing -- in the most economic, efficient and responsive manner. At the heart of such a goal is the concept of integrated end-user computing, with minimization of redundancy and elimination of duplication of effort.

The goal of end-user computing is to allow people (users) to access and manipulate their own data with a minimum of MIS intervention. MIS will ideally act only as a system administrator and a source of help and expertise (e.g. training, support, etc.). Because MIS is planning one integrated system which incorporates microcomputers, word processors and mainframes, end-user computing cannot be looked at as just personal computing, standalone word processing or user-friendly host processing. It is rather a melding of the three which creates a synergy heretofore unrealized in the Boston College environment. Of necessity, each portion of the system must be viewed in the context of its relative contribution to the whole. This will become even more paramount as the components of the system become more integrated and interdependent. Thus, when planning the overall strategy, MIS has tried to ensure that each subsystem not only addresses a specific need, but that its functions do not overlap or conflict with the functions of the others.

B. SERVICES

The following is an overview of the various products and functions Information Services will provide to create a comprehensive, integrated, and end-user computing environment.

Word/Text Processing Support

1. Host-based Letter Production Systems

- There are two types of production jobs under this category -- "ad hoc" and regular application programs.
- Name, address, and salutation information can be extracted from any administrative system.
- Records are selected according to pre-determined criteria, either program-dependent, as in the case of the application programs, or strictly supplied as parameters, as with the "ad hoc" system.
- All selected records are passed through a conversion routine to create upper and lower-case, expanded output; they are then sorted and written to a special word processing disc file.
- Center staff utilize terminal transactions to release these files to either the laser printer or a word processor for merging with a shell letter and envelope.

2. Host-based Text-generation Systems

- Various application programs have been developed to access administrative systems and extract records that are to be used as copy for university publications.

- The application program, in addition to converting the records as above, inserts the bulk of generic word processing/typesetting interface control characters and commands.
- The same terminal transactions and procedures are followed by Center staff to download the copy to a word processor for editing and coding prior to transmission to the typesetter.

3. Original Keyboarding

- Used to create shell letters and envelope instructions for the mass production of "personalized" letters.
- Used to create files for merge letters which are not yet supported by an application or "ad hoc" program or any other electronic generation or access method.
- Used to support departments without present access to a work station with the creation and revision of university publication copy.
- Production staff are also utilized to assist departments as a back-up and alternative to utilizing an outside service bureau or over-time, or experiencing missed deadlines.
- Used to input typesetting mnemonic codes prior to the electronic interface with typesetters, whenever competitive bidding results for each particular project show it to be cost effective.

4. Media Conversion

- All efforts should be made to preserve or capture original keystrokes. Through media conversion all re-keyboarding of information is eliminated.
- An OCR (optical character recognition) scanner or "typereader" is used to convert either archived documents in hard copy format to electronic media or newly-created copy between incompatible or non-communicating systems.
- Other specialized communication hardware and software are used in the Center for local conversion of both text and files from one supported system to another.
- Another rapidly-growing application for media conversion is typesetting via an electronic interface. Publication copy may be prepared on any supported system and then downloaded to the Center. Mnemonic typesetting codes are inserted to communicate the designer's specifications prior to telecommunicating the copy or sending the

electronic media to the typesetter. The savings in turnaround time and printing costs due to reduction of pages through typesetting, as well as the economy of utilizing word processing to prepare copy should also be considered.

5. Centralized Control Functions

- The Center is integrally involved in "tele-typesetting" publications coordination and control -- through a joint effort with the Purchasing Department and the Office of Communications. We are currently at the galley stage of producing our own publication production guide. Functions performed by the Center include the maintenance of an approved vendor list, with key interfacing information on file; sole vendor communications technical liaison; departmental publication coordinator liaison and support; sole source of coding for typesetting implementation; sole source of all possible communications equipment needed for such an interface.
- Centralization of supported, dedicated word processing configuration and inventory maintenance, including the recycling of equipment.
- Centralization of software and documentation upgrade distribution to insure that all users are working at the latest release.
- Ongoing vendor liaison and hardware/software testing and evaluation of both supported systems and the competition.
- Training and application support for all supported word processing software will be provided as outlined below.
- A system will also be centrally-located in the Walk-in Center for user-back-up, staff demonstration, or hands-on testing.

C. LOCAL PROCESSOR SUPPORT

1. Workstation Configuration

With the explosion of end-user computing rapidly becoming a reality at Boston College, MIS is trying to help individual offices get started in the right direction. At the crux of this issue is making sure that people have the right equipment for a particular job. Since this is the one of the most basic issues, MIS feels that it should be addressed first.

- Information Services will be the first contact for people interested in the administrative uses of microcomputers and word processors.
- We will also seek out and encourage individuals in high need areas to consider using an automated solution (e.g. workstation plan). By

configuring the equipment, we will be able to standardize on a limited number of devices. This will aid in connectivity, training, support, maintenance, etc.

- Because of standardization it will be fairly easy to transfer equipment between offices. This will occur more frequently as technology improves and certain individuals need more local processing power.
- New products (both hardware and software) will be tested by MIS on an ongoing basis.

2. Local Processor Hardware Support

In the interests of time and efficiency, MIS will not directly involve itself in issues of workstation procurement and maintenance.

- Once purchase is approved, the Boston College Computer Store will order and take delivery of the equipment.
- Maintenance of standardized equipment will be through the University Workshop.

3. Training and Support for Local Processing Software

Because it is the software which really performs the functions on a microcomputer or word processor, MIS anticipates that training and support will be the major factor influencing the success or failure of an end-user computing strategy. Consequently, a major emphasis will be placed on this role.

Certain software packages which address generic needs will be standardized. The main thrust of MIS's general software support will be to help train and support users on these packages.

a. Training

- Initial training will be coordinated with the installation of equipment according to the Workstation Distribution Proposal.
- Once a reasonable number of machines are installed, training will be tied to the hiring process. Positions which require computer use will be identified and new hires trained accordingly.
- Some computer-based training will be available for those who are interested.

b. Support

- Phone support will be available for standardized software (and to a lesser extent for non-standard software).

- One-on-one support will be available for application development only on standard software on a walk-in basis.

4. Walk-in Information Center

A walk-in center will be established which contains the various microcomputers, word processors and host terminals supported by MIS. Administrative users will be able to use the facility at any time during normal business hours.

- Hardware and software will be tested, evaluated, and demonstrated by MIS in the Information Center.
- Systems will be available as back ups for any department which needs them.
- Public terminals will be available.
- Specialized equipment will be available for general use (this includes graphics plotters, various printers, infrequently-used and expensive software, etc.).

D. HOST PROCESSOR SUPPORT

1. Connectivity Support

Once the use of personal computers becomes relatively widespread, the next logical question is how to more efficiently disseminate the wealth of information being generated. The majority of the raw information will still reside on the host computers. As a result, the most reasonable scheme is to connect local processing devices to the host and use it for communications as well as information storage. The two components involved in doing this are the physical connection between the devices and the software which controls the information exchange.

a. Physical Connection

- Hardware and software products for connecting various types of computing devices will be tested and evaluated by MIS (in conjunction with Computing Services).
- Workstation-to-workstation communications will be supported (Local Area Networks, to local minicomputers, and from modem to modem).
- Data file transfer between workstations will be supported for standardized software.
- Workstation-to-host connectivity will be supported (Coaxial connection, Asynchronous Interface through the PBX,Synchronous Interface through the PBX, dial-up through modems).

b. Controlling Software

- An information server will be installed on the VM mainframe to facilitate file uploading and downloading so that users need little technical knowledge of the intricacies involved.
- MIS will act as the central administrator for the information server. This involves monitoring utilization, assigning security levels, and providing user support.
- The server will allow a user to access and/or share data easily while maintaining a high level of security.
- Extracts from production files can be sent to the server instead of as a written report, allowing a user to reformat the output quickly and easily.

2. Electronic Office System

An electronic office system will be established to link all standard administrative computing devices together through a common distribution system. This system complements the information server in that it can transfer textual material more easily and efficiently, and it does not transfer data files. MIS will act as the administrator of this system, managing both security and support.

- The system will include a facility to create and edit transmittable documents from any workstation.
- Finished documents can be distributed to any number of people via electronic mail.
- Quick notes can be generated to other users, cutting down on "telephone tag."
- The mail system can be used to pass text to Word Processing specialized services (e.g. typesetting, high speed printing, etc.).
- A calendaring system would be available for individuals who choose to use it.

3. Redundant Database

A redundant database will be installed on the VM mainframe. It will be directly accessible to authorized users. This will allow the individual significantly greater freedom to analyze information without the possibility of damaging the integrity of production systems.

- Certain data agreed upon by MIS and the individual users would be loaded (and periodically refreshed) from the production system.

- A nonprocedural or menu driven system will be provided for entering, editing, and extracting data. Thus even a casual user will be able to accomplish a great deal without extensive training.
- This system will reduce users' dependence on MIS for a substantial number of information needs, thus freeing MIS to direct its attention toward major projects.
- The most basic function of this system would be to allow users to create custom reports with relative ease.
- Additional data fields can be created, and associated with production data.
- Subsets of information can be extracted and shared or downloaded (using the server).
- Security will be maintained at a level comparable to that on the production system.

4. Host Output

A report generator running off of the production system will be supported, as well as limited query facilities. Both services will be limited to individuals for whom timely information is truly critical.

- Because of the impact on other users of the production system, use of a report writer and/or query system will be limited.
- Individuals for whom this service is provided will have the capability of generating reports based on up to the minute information.

E. SUMMARY

A comprehensive, integrated, end-user computing system must address a wide variety of needs. These include information storage and retrieval on both host and local processors as well as the oft-emphasized issues of data manipulation and communication. All of this must be accomplished without requiring a user to become a computer guru. It is for this reason that the quality of support and training provided by the Information Center is so critical to the success of end-user computing.

A NEW ORGANIZATIONAL DESIGN
--NO NEW RESOURCES--
A METAMORPHOSIS

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ABSTRACT

Much like a butterfly emerging from a cocoon, the Department of Information Systems at San Francisco State University (SFSU) now consists of three functional centers:

(1) INFORMATION CENTER;
(2) DEVELOPMENT CENTER; and
(3) PRODUCTION/MAINTENANCE CENTER.

The premise of this paper is that Information Centers can evolve under the aegis of MIS and DP departments as these departments carefully distribute computing power to the people. Using the generic headings of YESTERDAY, TODAY and TOMORROW, a brief discussion of SFSU's needs which led to this metamorphosis is presented, followed by a focus on the way in which existing hardware, software, and personnel resources used to address those needs.

A NEW ORGANIZATION DESIGN
--NO NEW RESOURCES--
A METAMORPHOSIS

San Francisco State University was established in 1899. It survived the 1906 earthquake (although the facilities were lost), two world wars, and a major period of student unrest that resulted in a student strike which gained national attention. In 1961 San Francisco State became one of the 19 campuses in the California State University and Colleges (now called the California State University), the largest system of public higher education in the world.

The Fall 1984 headcount enrollment at SFSU was 24,170 resulting in an FTE of 17,853. Due to the limited physical capacity of the campus, enrollment is not expected to vary significantly in the years ahead. SFSU offers 65 diverse academic programs leading to bachelors' degrees, and 52 programs culminating in masters' degrees. Two doctoral programs of study are also available.

YESTERDAY

COMPUTING HARDWARE: The San Francisco State University Computer Center operated and maintained a number of computer systems providing a variety of services to the campus community. A Control Data Corporation CYBER 170/730 mainframe supported SFSU's administrative work, as well as general instructional computing and large-scale research programs. Interactive computer ports totaled 163 to the local CYBER, while another 32 asynchronous terminals were converted to synchronous transaction terminals via 3270 concentrators. A DEC PDP 11/70 minicomputer supporting 48 terminals ran a wide variety of software for instructional use. A DEC PDP 11/45 minicomputer provided word processing services for a number of campus offices. The State University Data Center in Los Angeles operated a CDC CYBER 170/760 mainframe which was available to users on all campuses for interactive and batch processing via a statewide data network. Total campus terminals numbered in excess of three hundred.

ADMINISTRATIVE SOFTWARE: Computing Services had been addressing the needs of the university administrative community in two ways. The Administrative Systems Group had approximately thirty administrative systems in production, although there seemed to be a perpetual backlog of requested enhancements to those systems. In addition, the Office of Institutional Research had initiated Decision Support Systems training and analytical support, which allowed the more computer literate administrative users to generate ad hoc reports using commonly known packages (e.g., SPSS, IFPS, INFOFETCH, DISSPLA). Both approaches promoted batch submission of jobs, however, due to the fact that the already-saturated mainframe was used in both cases.

PERSONNEL RESOURCES: Computing Services consisted of four major divisions: (1) Instructional Computing, (2) Institutional Research, (3) Administrative Systems, and (4) Computing Operations. The organization chart entitled "YESTERDAY'S FUNCTIONS" shows how the staff time was functionally distributed. Administrative users complained regularly about the backlog of requested administrative projects, and attendance increased in the various seminars for Decision Support System training.

TODAY

COMPUTING HARDWARE: In keeping with the adopted philosophy of "User submission of jobs / User control of data," SFSU has promoted an increase in both number and variety of computing hardware. Two local area networks (LANs) have been established, one for instruction within the School of Business and the second for administrative use. Both LANs consist of IBM PCs connected to ALTOS 586 file servers, using ETHERNET for communications. The campus mainframe is effectively saturated, with administrative systems' storage in excess of 675 million characters, growing at the rate of approximately 240 million characters per year. Screen response time for large on-line administrative systems averages between one and four minutes. Given the saturation of the PDP 11/45 (used for administrative word processing), departments are purchasing stand-alone microcomputers to support their word processing needs.

ADMINISTRATIVE SOFTWARE: Several administrative offices within the university have bought microcomputers for further computing power, and a local area network using Ethernet has been established among five such offices. This increased availability of computing power has led to an increased need for knowledge about appropriate uses of the hardware and software now proliferating on the campus.

Experimentation with downloading of data from the mainframe and uploading of updates has begun with three pilot projects. Data entry, still centralized within Computer Operations, is using the administrative LAN to update data files (thus replacing the keypunch). Working with the Department of Information Systems, the Cashier's Office will purchase a cash receipting minicomputer which produces a number of departmental reports as well as communicates with the campus mainframe. Given the CYBER saturation, Information Systems has advised the Office of Admissions and Records to pursue the development of "Advanced Standing Evaluations" on the LAN, using data downloaded from the campus mainframe.

Stand-alone microcomputing applications further offload the campus mainframe. Assistance is therefore being provided by Information Systems staff for the SFSU Mail Room, which has a Pitney Bowes postage machine communicating directly with an IBM PC.

PERSONNEL RESOURCES: Computing Services now consists of three major divisions: (1) Instructional Computing, (2) Information Systems, and (3) Computing Operations. The offices os Institutional Research and Administrative Systems have merged, their combined efforts now headed by the Associate Director of Information Systems.

The Department of Information Systems is further separated into three functional centers: (a) Information Center, (b) Development Center, and (c) Production (Maintenance) Center. The organization chart entitled "TODAY'S FUNCTIONS" shows how the staff members are now functionally distributed. Cross training among members of the formerly independent offices has increased overall productivity significantly. Given the opportunity to participate in all three centers, staff morale within Information Systems is high.

Administrative users have a voice in the priority setting of Information Systems through regularly scheduled committee meetings. Beyond the committee structure, they can request computing assistance, training, or consultation from the Associate Director of Information Systems. Based on analysis of user requirements, available software and alternative hardware configurations, the request is assigned to one of the three centers. A "request tracking system" has been installed to assist progress measurement.

TOMORROW

COMPUTING HARDWARE: "User control of data / User submission of jobs" translates into a more user-friendly computing environment than currently exists. Two scenarios are being pursued: (1) a bigger, more expensive mainframe to hold only administrative data, and (2) departmental microcomputers and minicomputers which communicate with each other through a central switch maintained by the Department of Computer Operations.

A campus high-speed data communications network will be established, using standard CATV cable and signal equipment. "Bridges" will be provided to connect the campus-wide network to local networks within buildings and departments, including all central computing equipment at the Computer Center. It will provide the basis for high-speed file-transfer and file-server access between all connected systems, as well as supplementing the twisted pair network for terminal access. This network is planned to interconnect effectively with the California State

University-wide X.25 network.

COMPUTING SOFTWARE: A library of microcomputer software will be available, from which appropriate software packages will be demonstrated for any potential user requesting it. Regularly scheduled "short courses" will encourage the novice computer user to experiment with available technology. A demonstration room will be set up for various types of computer hardware on which the software packages will run.

The concept of "departmental computing" will be further explored. Administrative users will be encouraged to create as well as submit their own computer jobs. Information Systems will transfer staff positions to these user departments as necessary in order to encourage this distributed processing.

PERSONNEL RESOURCES: Computing Services will consist of the same three major divisions, but further functional changes will occur. Instructional Computing will consist of four functional centers: (a) Information Center, (b) Computing Laboratory Management, (c) Artificial Intelligence Research, and (d) Faculty Research Support. Computing Operations, by contrast, will limit its functions to Systems Programming, Computing Operations, and Computing Repairs and Equipment Maintenance.

CONCLUSION

It is clear from this example that an Information Center can be established from existing hardware, software, and personnel resources on a campus. The success of this implementation further indicates that participatory management driven by the policy of "User submission of jobs / User control of data" inhibits the possible paranoia of MIS and DP departments when distributed data processing and decentralized computing are promoted. Finally, whether we choose to recognize it or not, in many instances the most computer literate people in an organization are associated with the Computer Center.

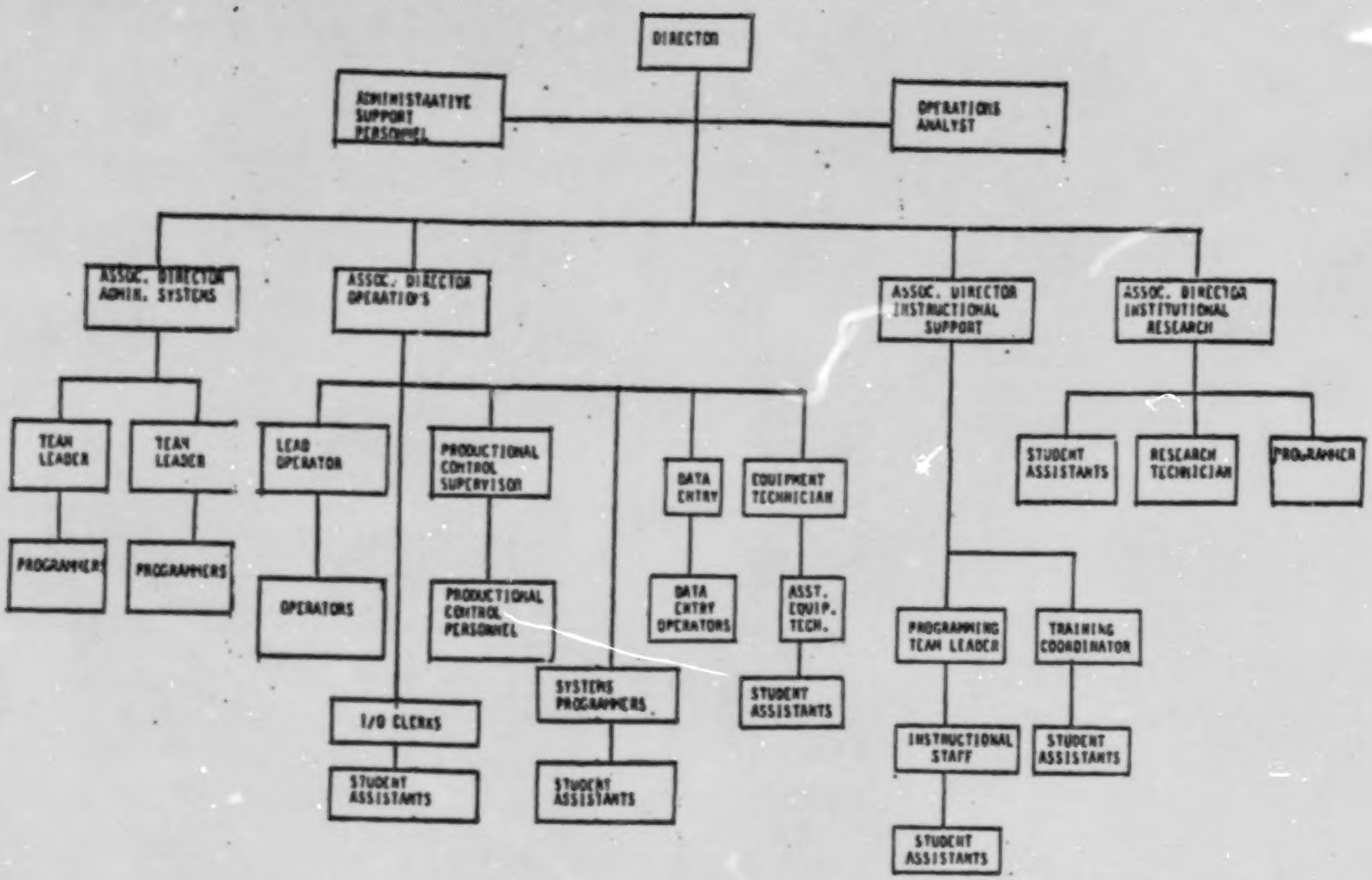
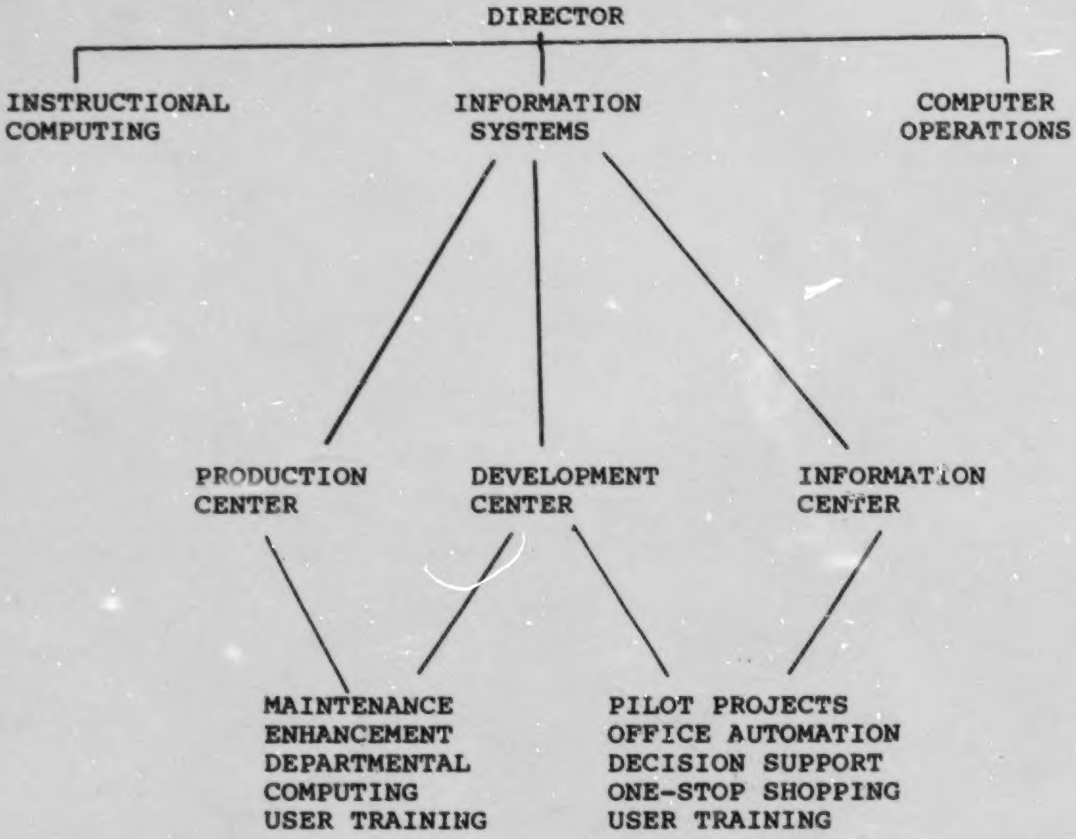

DIRECTOR
ADMINISTRATIVE SUPPORT PERSONNEL
OPERATIONS ANALYST
ASSOC. DIRECTOR ADMIN. SYSTEMS
ASSOC. DIRECTOR OPERATIONS
ASSOC. DIRECTOR INSTRUCTIONAL SUPPORT
ASSOC. DIRECTOR INSTITUTIONAL RESEARCH
TEAM LEADER
TEAM LEADER
PROGRAMMERS
PROGRAMMERS
LEAD OPERATOR
OPERATORS
PRODUCTIONAL CONTROL SUPERVISOR
PRODUCTIONAL CONTROL PERSONNEL
DATA ENTRY
DATA ENTRY OPERATORS
EQUIPMENT TECHNICIAN
ASST. EQUIP. TECH.
STUDENT ASSISTANTS
SYSTEMS PROGRAMMERS
STUDENT ASSISTANTS
I/O CLERKS
STUDENT ASSISTANTS
PROGRAMMING TEAM LEADER
INSTRUCTIONAL STAFF
STUDENT ASSISTANTS
TRAINING COORDINATOR
STUDENT ASSISTANTS
STUDENT ASSISTANTS
RESEARCH TECHNICIAN
PROGRAMMER

EXHIBIT A

BEST COPY AVAILABLE

TODAY'S FUNCTIONAL ORGANIZATION


DIRECTOR
INSTRUCTIONAL COMPUTING
INFORMATION SYSTEMS
COMPUTER OPERATIONS
PRODUCTION CENTER
DEVELOPMENT CENTER
INFORMATION CENTER
MAINTENANCE
ENHANCEMENT
DEPARTMENTAL COMPUTING
USER TRAINING
PILOT PROJECTS
OFFICE AUTOMATION
DECISION SUPPORT
ONE-STOP SHOPPING
USER TRAINING

BOOTSTRAPPING THE INFORMATION CENTER

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Abstract

At Northern Kentucky University the need to provide information center services to support user computing - mainframe and micro - had been identified and implementation plans developed. Lack of funding postponed formal implementation beyond the current fiscal year. However, external events intervened, culminating in a major institutional purchase of microcomputers for support of office automation efforts. This paper describes the process used to organize existing institutional resources under a contingency plan to provide essential support services to new micro users.

Introduction

There was an urgent need to provide instructional support for university administrators and staff who were soon to receive microcomputers in their offices, but there was no money in the 1984-85 budget for this purpose. Thus began a crash program to provide the necessary instruction as one step on the path toward institutional computer literacy at Northern Kentucky University.

How did NKU get into a situation of providing equipment but nothing for training? The instructional need had been recognized but external events intervened in the institution's plans. The problem we faced was a matter of timing, not a lack of planning.

Background

At NKU, computing and the other major information resources are organizationally grouped under the umbrella of "Information Management", reporting to the Assistant Vice President (the chief information officer). The need to promote and develop user computing - both mainframe and micro - had been identified and reinforced in a number of approved information management planning documents, including the long range information systems plan, the information management development plan, and the office automation action plan.

The office automation action plan developed last year by the Assistant Vice President for Information Management was of particular significance. Responding to a task force report on office information processing needs, the action plan called for purchasing a dedicated word processing system and microcomputers to meet campus office automation needs. The plan had been reviewed and approved by the Information Management Policy Committee whose membership is drawn from the President's executive staff. In keeping with the direction established by the plan, 1984-85 budget requests submitted by the Assistant Vice President included an estimated operating budget for the word processing system and new support staff to provide coordination and training support for both word processing and user computing.

During the budget process both the personnel and the operating budget requests were disapproved with the rationale that the word processing program would be addressed in its entirety later in the spring semester while any additional microcomputing was expected to be funded on a very modest scale during FY 84-85. Finances suggested that a major institutional micro effort be postponed until the following fiscal year.

Events moved quickly during the spring semester. After on-campus demonstrations of word processing equipment were held for office personnel, a specific vendor line was selected. During the same time period, a committee charged with reviewing microcomputers identified three specific models to be placed on a list approved for purchase with institutional funds.

Thus the stage was already set when external influences came into play. In April, the University was approached by one of the three approved microcomputer vendors with a discount plan available to all institutions in the Kentucky State University System. Any micro purchases completed before the end of May would be discounted by more than half. This truly was "an offer we could not refuse", and the University decided to act. Reserve funds were allocated for the purchase of 100 micro systems; 80 of them assigned to campus offices and the remaining 20 scheduled for placement in a computer literacy lab. (At that point in time, other training needs were addressed only as a problem to be resolved after the order was placed.) A centralized configuration effort took place, during which both hardware and initial software packages were matched to individual office needs.

Because of the desire to purchase as many microcomputers as possible while the major discount was in effect, a decision had been made to scale down the original configuration for dedicated word processing equipment. As soon as the micro order was placed, the chief information officer worked with the President and his executive staff to refine the dedicated word processing system configuration. This order was placed in mid-July just as the micros began to arrive on campus.

Not only was NKU moving rapidly into office automation activities, the unexpected discount also enabled the institution to move aggressively into a planned faculty/staff computer literacy program.

The NKU Computer Literacy Plan

Computer literacy for faculty and staff had been set as an institutional goal by Northern Kentucky University's president. To define the conceptual approach for the program and develop an implementation plan, the Associate Provost and the Assistant Vice President for Information Management worked together. Building on the Assistant Vice President's previous experience in implementing a computer literacy effort and the Associate Provost's extensive study and analysis of computer literacy programs at other institutions, the two officers agreed on the general content and a delivery plan for NKU.

Northern adopted as its own the definition of computer literacy pioneered by the Minnesota Educational Computing Consortium (MECC): "Whatever understanding, skills and attitudes one needs to function effectively within a given role that directly or indirectly involves computers."[1]

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[1] D.L. Klassen and R.E. Anderson."Computer Literacy" in H.S. Kepner (Ed.), Computers in the Classroom. Washington, D.C., National Education Association of the United States, 1982.

As interpreted for NKU, the basic computer literacy program should contain both knowledge about computers and hands-on experience with operating system utilities, word processing, spread sheets, graphics and data base management systems. Advanced level work in each of these areas and in programming languages or instructional authoring systems should also be included for some personnel.

The delivery approach follows the three-layered "Indiana plan".[2] All participants will be given instruction about computers (how they work, the different types and sizes, and appropriate functions for each computer type). Everyone will also have some hands-on experience in the five types of software listed above. The third layer of instruction will be tailored to the needs of the various groups. It will, at a minimum, include additional experience with software which is relevant to the individual's role at the University. For some faculty members in specialized areas, advance instruction may also include some programming. Programming will not be required as part of the general literacy program, however.

Early on in the development of the conceptual plan, it became evident that one set of classes would not be appropriate for all participants although there are topics of mutual interest. Faculty needs and interests focus on integrating computers into the curriculum, while administrators and staff are interested in integrating computers into the office as decision support and office automation tools.

These differences led to the decision to share an institutional curriculum for computer literacy, but to tailor the delivery mechanism to fit the different audiences. Academic Affairs would be responsible for instruction focused on computers in the curriculum and Information Management would provide instructional support for computers in the office setting. The latter activity would be viewed as a continuation and expansion of a service function traditionally supplied by the information management group. To prevent duplication of effort, it was also agreed that any general courses developed which could effectively meet the needs of both groups should be available to all interested employees.

Implementation

The sudden availability of equipment accelerated everyone's schedule. However, in contrast to the faculty program where instruction to develop computer literacy will create faculty demand for micros, the arrival of micros in university offices created a demand for instruction. Thus the administrator/staff instructional problem was of immediate concern. This need had to be addressed using whatever means could be made available and a contingency plan was implemented.

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[2] J.V. Lombardi. Faculty Computer Literacy: The Indiana Plan. Bloomington, Indiana: Indiana University, 1983.

The original plan to develop a formal information center to support user computing of all types was scaled down to a pilot project focused solely on micros and dedicated word processing equipment. Instruction would be provided by a cadre of part-time personnel, with project coordination for the 1984-85 pilot year provided through the Office of Information Management. Funding for the pilot came from multiple sources:

The President transferred money from the fund balance to cover maintenance and operating expenses for the dedicated word processing system and to provide some initial micro training classes for office personnel. A general introduction to microcomputers and word processing courses were contracted through the computer vendor. The budget allocation for this purpose made a major impact by providing a fast startup in productive utilization of micros as word processors in our campus offices. The initial classes were completed prior to start of the fall semester, which allowed secretaries to get comfortable with the new equipment prior to the Fall rush; a significant benefit for the academic area.

Institutional operating budgets were reworked to eke out some additional dollars for continued training. The Vice President for Administration and the Provost worked together to provide funding to release a faculty member on a half-time basis to organize and administer the dedicated word processing system and to conduct inhouse training. The new word processing coordinator is a highly skilled word processing instructor at the University who agreed to also provide instruction for word processing software on the microcomputers. The Vice President for Administration reassigned a secretary to provide staff support to the word processing/office automation area. He also reallocated some staff development dollars to provide funding for a part-time microconsultant who would assist users with problems, lead workshops and, on a limited basis, provide individual or small group instruction.

The Assistant Vice President raided the information management office budget, reallocating funds to provide instructor stipends for courses in Lotus 1-2-3[3] and the Condor 3 relational data base management system.[4] Information Management also purchased a number of instructor manuals and self-tutorial materials to augment the formal instructional program and is supporting several low-cost enhancements to the program: A monthly "Help Lines" newsletter containing class schedules, helpful hints, and articles of general interest is being distributed to over 130 micro and word processing users. User groups have been formed for each of the major software packages to help reinforce formal classes and to share creative uses for the technology.

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[3] Lotus 1-2-3 is a registered trademark of the Lotus Development Corporation.

[4] Condor 3 is a registered trademark of the Condor Computer Corporation.

Preliminary Assessment

After only five months into the pilot project, it is too soon to make a summative evaluation. Several observations, comments and concerns are in order, however.

1. The funding uncertainty created major problems for the start-up of the pilot project. Coordination of the entire word processing/micro pilot has been permeated by a feeling that we are running to catch a train that has already left the station. For example, release time for the word processing coordinator was not settled until the start of the fall semester, leaving virtually no time for the coordinator to learn the new word processing packages before he was feeling pressure to offer the courses. The late decision also created a situation where the word processing coordinator was organizing the office automation facility and arranging for delivery and installation of the system during the same time period his scheduled university classes were getting underway.

The month of September was consumed by the effort to locate qualified instructors for the other micro software courses, to find an available, knowledgeable, part-time person as a micro consultant and to complete all of the administrative tasks necessary to schedule classes, arrange payrolls, to publish and distribute the first edition of the newsletter and to assist the first user group as it got underway. By October, however, the major pieces were in place and continuation of the instructional program was underway.

2. There is a need for an overview course for administrators, which will provide an introduction to basic computer concepts and also include brief hands-on experience with each of the major software groups. While some administrators have taken advantage of the available courses which are open to all, others need the security of separate class sections where they can learn about computers surrounded only by peers. There is very real anxiety over displaying lack of computer skills in front of office staff.

Instructional staff have been spread too thin to take on additional course development during the Fall semester. However, this is an area of top priority for the spring semester.

3. Despite the start-up difficulties, the pilot project is off to a good start and appears to be making a positive impact far beyond its modest cost. Workshops and classes have been well attended and a number of offices are moving beyond basic word processing into advance applications:

The Budget and Planning Office and the Accounting Office are already making productive use of the Lotue 1-2-3 spreadsheet for analysis purposes. A number of other offices are monitoring their own budgets wih Lotus models, while the Institutional Research Office is using Lotus spreadsheets and graphs to prepare the yearly fact book. Four offices set up departmental data bases even while completing the series of Condor classes. A number of others are in the planning stages. Word processing is so fully integrated into the daily office routine that some department heads are now experiencing difficulty scheduling time on the office micro for decision support activities of their own.

The micro consultant position has proven to be an essential support service. Beyond his initial duties, the consultant helps instructors during class sessions, prepares materials for class use, and is also now teaching a class in operating system utilities.

The support program for the dedicated word processing hardware is moving ahead without incident. The administrative coordination of the system installation proceeded smoothly under the direction of the Word Processing Coordinator. The Coordinator has used the vendor's word processing equipment for several years in teaching university classes so there are few new challenges in this instructional area.

4. It was only possible to lauch the instructional program on such short notice because of the university setting with its faculty resources. NKU has a large non-traditional student population, and University faculty are experienced and comfortable with teaching adult learners. Key faculty for the project include the chairman of the Information Systems Department, the Assistant Director of Computer Services and the new Coordinator of Word Processing, all of whom regularly teach at the University. Motivated to provide service to the University, these individuals added the office automation courses to already crowded schedules.

A second key factor which enabled rapid program implementation was the existance of defined plans for support of user computing and the computer literacy program. No additional time was needed to develop conceptual plans; we were able to focus on specific course needs and providing the delivery system. With goals already established, it became a matter of refocusing resources and developing a contingency plan for implementation.

The Next Steps

Plans for the second semester include efforts to expand course offerings, adding new courses directed specifically toward administrators. Additional word processing courses - introductory and advance - will also be added to the available offerings.

Repeat sections of the original courses will be offered, (word processing, data base, spread sheet and graphics, and utilities) including some sections limited solely to administrators.

Steps will also be taken to insure that the dollars and staff necessary to continue the program are built into the new budget. Program review and evaluation will be conducted as a basis for refining the courses developed "on the firing line" during the first year. Although the pilot project has served to introduce user computing and the information center concept at Northern Kentucky University, much remains to be done.

Conclusions

Despite the obvious difficulties encountered, there were some positive aspects to the rapid system configuration and implementation process:

- The centralized configuration of software allowed us to limit the number of discrete software packages and minimize the number of different courses needed for user support.
- The nature of a pilot program lends itself to experimentation and rapid adaptation.
- The pressure to initially focus on immediate office needs before offering a structured general literacy course had some interesting side effects:
    - Because it is easier to develop classes for specific applications, the program could get underway with a shorter lead time for course development.
    - Once participants became comfortable with the applications software, they asked to learn more about the computer systems; this provided a natural lead-in to basic computer concepts.

Baldridge, et al support the need for formal training programs for faculty and staff, declaring that such instruction "is mandatory."[5] They stress the disadvantages of do-it-yourself approaches to micro instruction which include the extremely long start-up time that is required, the resultant frustration that can accompany the process, unevenness in what is learned, and the probability that most users will not get beyond an elementary level of expertise on their own.[6] These findings are corroborated by the experience of business and industry where "Corporations are finding that training, expensive as it may seem, is more cost effective than losing productive labor hours by letting employees teach themselves."[7]

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[5] J.V. Baldridge, J.W. Roberts and T.A. Weiner, The Campus and the MicroComputer Revolution. New York: American Council on Education, 1984, p. 98.

[6] Ibid., pp. 99-100.

[7] N. Steidtmann. "PC Training: Which Way to Go?" PC World, September, 1984, p.52.

This writer's experience with computer literacy/user-computing programs also supports what is documented in the literature on computer literacy programs and on information centers: instruction is vital. An organized instructional program provides time to work with the computer, removes employees from office distractions and interruptions, cuts through the gibberish found in most software manuals and focuses on significant material. A training program can also provide more in-depth coverage and focus on specialized information of relevance to the particular audience. The recent experience at NKU leads to the conclusion that even with the "rough edges" which accompany rapid implementation, almost any organized program of instruction will be more effective than do-it-yourself approaches.

BIBLIOGRAPHY

Baldridge, J. V., Roberts, J. W., and Weiner, T. A. *The Campus and the MicroComputer Revolution - Advice for Non-Technical Decision Makers*. New York: American Council on Education/MacMillan, 1984.

Doty, K. E. and Krumrey, A. J. "Administrators Build their own systems at Loyola University." *Cause/Effect*, September, 1982, pp. 20-23.

Drexel University. "Organizing the Program." Working Paper from the Drexel University Microcomputing Program, Philadelphia, PA, 1984.

Harrington, J. M. "Introducing Microcomputers Successfully." *Infosystems*, March, 1984, pp. 44-46.

Klassen, D. L., and Anderson, R. E. "Computer Literacy." In H.S. Kepner (Ed.), *Computers in the Classroom*. Washington, D.C., National Education Association of the United States, 1982.

Lombardi, J. V. "Faculty Computer Literacy: The Indiana Plan." Bloomington, IN, Indiana University, 1983.

Martin, James. *Application Development Without Programmers*. Englewood Cliffs, NJ: Prentice-Hall, 1982.

McKibbin, W. L. "Training PC Users." *Infosystems*, April, 1984, pp. 36-40.

O'Mara, J. "Building An Information Center That Works," *ICP Data Processing Management*, Autumn, 1984, pp. 24-26.

Rhodes, W. L., Jr. "The Information Center Extends a Helping Hand." *Infosystems*, January 1983, pp. 26-30.

Seymour, J. *Coping With Computer Egos*. New York: AMA Membership Publications Division, 1984.

Steidtmann, N. "PC Training: Which Way to Go?" *PC World*, September, 1984, pp. 48-53.

The Information Center Role Within the Overall Information Resources Management Program

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Abstract

This paper deals with the changing role of the Information Center at Arizona State University and the Information Center's place in the Information Resources Management organization.

The Information Center Role Within the Overall Information Resources Management Program

INTRODUCTION

Arizona State University reorganized major portions of the University in 1982. Part of this reorganization was the formation of the Information Resources Management department and the inclusion of most of the information related functions of the university in that department. These functions are included in the following departments. (Also see chart)

- Computing Services.

  Academic Computing Services

    All academic microcomputer, research, instructional, and graphics support groups. Remote instructional site operations.

  Administrative Computing Services

    "Traditional" systems and programming support staff for administrative computing.

  Information Center

    Mainframe and micro support for end user administrative computing.

  Data Communications

    Network management, planning and operations.

  Central Computing Services

    Database management, mainframe and mini computer systems support, capacity planning and central computer site operations.

  Computing Support Services.

    Data and text conversion, management support, and user interface services (help desk).

- Media Services. Includes three major areas.

  Media and Instructional Design Services.

  Design and development of instructional products, including instructional television and instructional design.

  Campus Services.

  Campus mail services, audiovisual equipment circulation and repair, forms design and analysis, printing services and publications.

  Film Library Management

  Administers a 9,000 print film library for circulation to Arizona's public schools.

- Telecommunications.

  The campus telephone network, and technical support and repair of peripherals (terminals, micro computers).

- Information Administration.

  This department is presently not filled. The purpose of Information (or Data) Administration is to to act as a control function for the University's data base. This is not limited to the data sets or data bases on the mainframe computer or even to that data plus the data bases on personal computers. In many cases it may include manually maintained data files.

To incorporate the above functions within an Information Resources Management unit is uncommon among colleges and universities. We think it has worked to our avantage so far and will continue to grow in importance to the Information Center as time passes. We will discuss the reasons for this growing interdependence and importance in this paper.

HISTORY

In the past two years, the Information Center has experienced limited need for interaction with most of the other departments within IRM except those in Computing Services themselves. This tends to support our decision to place the IC within Computing Services.

Our Information Center's purpose is to serve the administration of the university. Originally we had the following goals:

WORD PROCESSING. Support word processing. In 1982, our word processing function was primarily a series of terminals on two PDP 11/70 mini computers, running a program called Word-11. In addition, some IBM Displaywriters were in use and a very few micro computers could be found running a word processing program called WordStar.

DECISION SUPPORT. Support the decision makers of the administration with mainframe products that allow ad hoc inquiry into the university's administrative database.

MICRO COMPUTER SUPPORT. Help control the infusion of micro computers which was just beginning to have impact.

ELECTRONIC MAIL. Search out, recommend and implement an electronic mail system for the campus.

TODAY

The Information Center shares an Amdahl 470/V8 mainframe computer using IBM's Virtual Machine (VM) operating system. The Administrative Database runs under MVS on this machine utilizing ten megabytes. We use the Conversational Monitor System (CMS) and utilize six megabytes of main memory. On the mainframe we offer the electronic mail/calendaring system PROFS, we also have an ad hoc inquire system called Inquire and a spread sheet called Dynacalc.

The administration has over 250 micro computers, predominantly IBM PCs or XTs. On PCs the administration has the typical array of Lotus 1 2 3, dBase II and Wordstar (or variants). We support a fixed set of these products. That support has primarily been training. One 'goal' that was added to our original set was to try to keep up with our users on micro computers.

In pursuing our goals, our most frequent contacts within Computing Services are with Central Computing Services for changes to our mainframe software and addition of new users to the mainframe system. The next most frequent interaction is with Administrative Computing to be sure we are not solving a problem they already have solved and to coordinate the extraction of data from the Administrative Database for loading to the Information Center mainframe for end user analysis and reporting. Nearly all contact within Computing Services currently concerns mainframe access, not personal computer problems or applications.

In Telecommunications, our contact is with the Tech Shop concerning service for personal computers almost exclusively. They offer maintenance contracts and new user setup services for PCs. By including their technical support services for personal computers, peripherals and cabling, we can offer the personal computer user the consulting to see what hardware and software to buy; the service to install the hardware and software when it arrives; the continuing maintenance of that equipment; training of the users on most phases of use of their hardware and software; and support of end user application development using standard packages.

It is also typical that the initiation of interaction is from the Information Center, not other Computing Services departments or Telecommunications. They respond to our requests for service far more frequently than we are requested to perform service for them. Our benefit to them is their reduced need to support micro computers, some relief of report writing the user has been trained to do, and the general benefit of more people to help solve data processing problems.

FUTURE

There are several factors that will draw IRM departments into greater interaction with each other in the future. The predominant factors will be the change in communications technology and the convergence of several existing and new technologies such as data processing and graphic arts. We tend to focus these into two major categories, data interchange and document preparation.

In the communications field, ASU is in the process of aquiring a new telephone system. If the telephone system was controlled outside of IRM, we might have missed the opportunity to include a broad band network and other data oriented technology in our plans. As it is, the new telephone system will provide the backbone for our data as well as voice communications on the campus.

The example of the convergence of technologies, that of data processing and graphic art, should simplify the end user's task of producing quite sophisticated papers, books and other materials. These materials might be on paper, slides, video tape or whatever, and might include graphics, color, sound or the integration of several means of presenting information.

The following are two examples of how these changes might impact the IRM department.

Document Preparation.

We plan to have coordinated document interchange and composition, with word processing becoming a subset of this goal.

Suppose we have an administrator who wishes to publish a monograph on some esoteric subject (such as The Information Center Role Within the Overall Information Resources Management Program). One of the first steps might be a computer search of current publications pertaining to the subject. This search can be done using a personal computer, a modem and some communications software and dialing in to data bases that specialize in providing publications or at least abstracts of publications on line. After aquiring an annotated biliography from the appropriate data bases, the administrator might submit that list via the campus network to the library computer. Software on the library computer can be used to see how many of the publications in the list are contained in the library.

After studying the appropriate publications and other research, the administrator might begin preparing the text of the monograph by working on a personal computer at home. The administrator might be integrating graphics or color illustrations or calling on a standard form or outline from a library of standards to make his or her monograph consistent with a University, College or departmental standard. Certain data might come from his or her own research contained on the mainframe and/or on a PC in the office or at home. All of these features would be available in electronic form from one or more 'libraries' of software and data.

The integration of these features might be an iterative process. For example, he or she might prepare a very rough draft at home over several evenings, then transmit the file over a telephone line to the office for loading into a personal computer used by secretarial staff for further refinement or inclusion of illustrations or graphs they are trained to manipulate. From there it might go back to the administrator for review or be passed through a network to a printer that can handle all the features required to produce the color, illustrations or graphics included in the monograph. There might only be one such printer on campus due to its price or specialized needs. This printer would probably be located in Campus Publishing Services which could have the ability to further refine the monograph; make multi copies, bind it and mail it to a predetermined list.

From the above brief example we can see the need for close interaction with several IRM departments. The interchange of the data involves Telecommunications and Data Communications. You can see the tremendous impact this could have on a traditional "print shop" publications department. The

Information Center would be involved at various levels such as, training the user on the word processor(s), documenting the use of many of the available tools, helping in the search and extraction of any external data (the initial bibliography), help in the selection of the appropriate hardware and software that accomplishes this fancy scenario, and in coordinating service among the many departments in the chain from inception to production of the final bound volume.

Data Interchange.

We can see data interchange taking place in the Document Processing example but here is a more specific example. Imagine a scenario where a professor would have a grading system on a personal computer. The professor could receive a file of all the students who registered for the approriate class from the mainframe student registration master file at the beginning of a semester. He or she could load these into a software package that might include several features like the ability to enter and modify grades, and analyze student/class/exam performance. The final step would be to upload the class results to the mainframe and update the student master records at the end of a semester.

Again it is apparent there will be heavy reliance on many IRM functions to accomplish data interchange between the mainframe and personal computers or other mainframes. Much data interchange on a routine basis will wait until our broadband network is installed along with the new telephone system. The uploading and downloading of data now is not a routine task and is seldom if ever under computer control. Currently, the best way to download data is via dial-in at 1200 baud and which very slow. For example, this paper was done on a PC using a word processor, uploaded to the mainframe and then downloaded to a Displaywriter for final revision and printing. That is a lot of tiresome loading around of data in order to have a nice finished product. We have several people in Academic Computing services, the Information Center and Telecommunications working jointly on perfecting better means of uploading and downloading.

THE DEVELOPMENT CENTER

Administrative Computing Services has recently started a Development Center for the purpose of finding and implementing new software technologies to improve the systems development cycle time, primarily on the mainframe. As this group reaches critical mass, the Information Center will be heavily involved in the development of new systems. One model proposed is for the Information Center to do most of the report development and generation for a new system. In fact that means having the end user of the system do the report generation and be able to make modifications or additions to reporting, with little or no intervention from Administrative Computing Services. The tools we have in place for this, Inquire and Dynacalc, are being evaluated by the Development Center and the Information Center. It is quite possible these tools will be augmented or replaced as recommended by these two groups, in order to meet the needs of the user.

THE INFORMATION ADMINISTRATOR

The Information Administration box in the organization chart for IRM has not been filled. We feel this will be a crucial function for the Information Center. As more and more personal computers are put to use with more and more data bases, at best loosely associated with the main data base of the university, the central data dictionary under control of one Administrator will become mandatory. This data dictionary will have to contain current information about virtually every data item the university has need of at nearly every level of the organization. The data dictionary will probably contain at least the definition of the data, the location of the data, the owner and maintainer of the data, the users of the data, and how often it is modified.

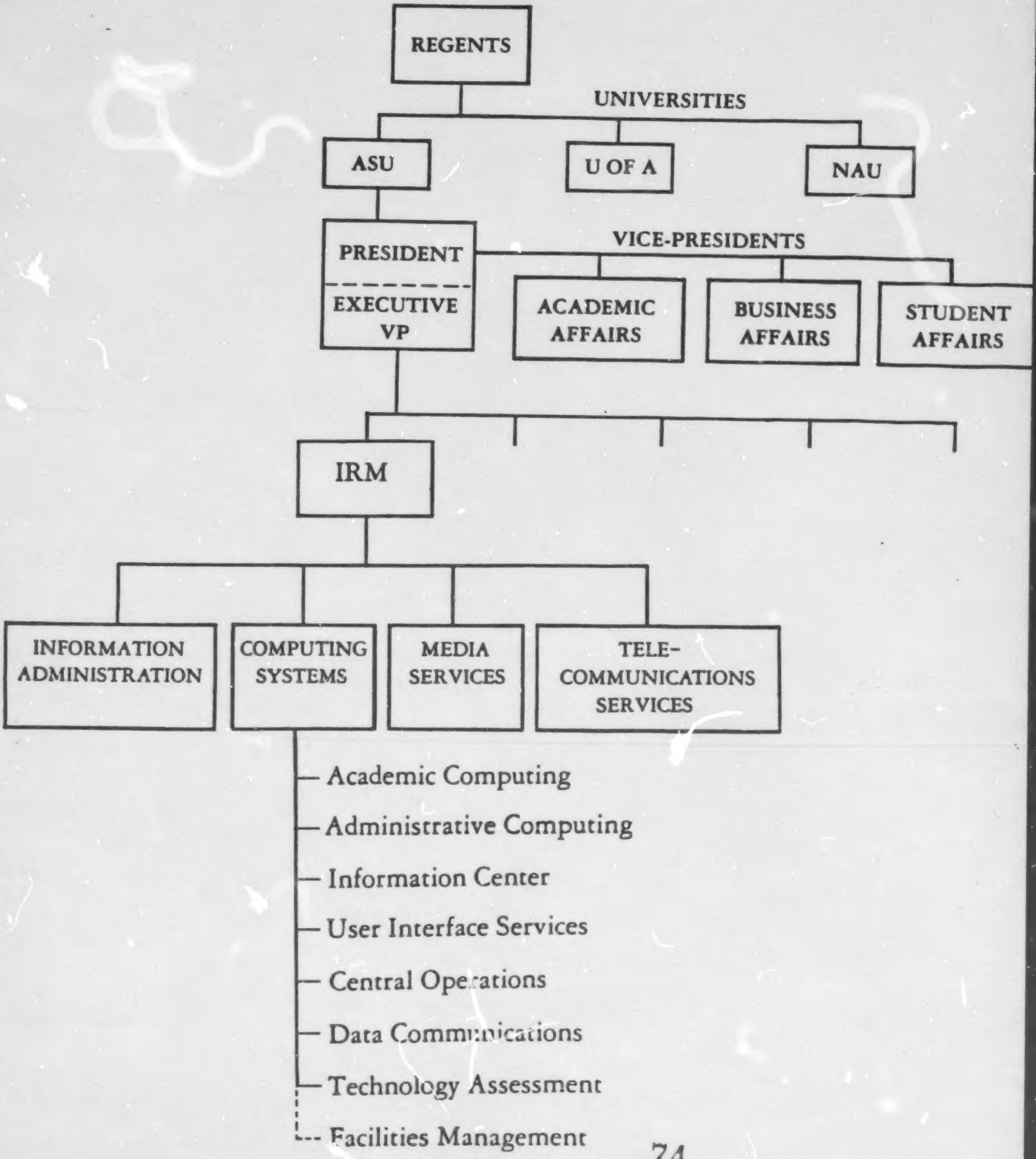
As the Information Center moves into the design of systems it will be necessary to reference this data dictionary in order to know where the current data is and who owns it. You may have seen organization charts with an Information Center in the Data Administrator's area. We have left that for the future but we think Information Administrator's administration of the data dictionary will involve Administrative and Academic Computing Services and the Information Center. They have equal footing now and we will probably leave these functions where they are in the organization.

CONCLUSION

From the above we can see a rapidly growing interdependence in many departments within IRM. We seem to have some distinct advantages. First we could reorganize IRM, if necessary, to better suit changing conditions. Second, we are able to meet the growth and change in communications technology, the influx of PC's and the general upgrade of computer technology with most if not all technical participants under one department. Third, changes seem to surface and become more apparent in our IRM structure than if we were more fragmented.

We have seen that many areas are becoming dependent on each other for support, such as in uploading and downloading of data; microcomputer support; new technologies; generation of new software and reports; and training and upgrading people. Much of this dependence is in areas that did not exist five years ago, using hardware that was not even on the drawing boards three years ago, and requiring software that probably had a major revision or announcement in the last ten minutes. We are convinced the Information Resources Management organization has helped us cope with this onrushing change in ways we might have missed without it.

ASU ORGANIZATION



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PROFESSIONAL PRESENTATIONS

The CAUSE84 theme, "Information Management Basics in a New Technological Era," was addressed through forty-nine professional presentations in seven subject tracks, as well as less formal sessions on topics of special interest.

SPECIAL INTEREST SESSIONS

The conference provided informal sessions for conferees to meet and exchange ideas on topics of special interest or concern. At eight such scheduled sessions, conferees met to discuss the topics listed below. Summaries of these follow in this section.

AXXESS (BYYTEBAACK)
Moderator: Michael Zastrocky
Regis College (Colorado)

IMS
Moderator: Ralph Boe
Louisiana State University

INSTITUTIONAL RESEARCH AND COMPUTING
Moderators: Richard Howard
North Carolina State University
and
Gerald McLaughlin
Virginia Tech

OFFICE AUTOMATION
Moderator: Herb Bomzer
Fordham University

+DECISION SUPPORT SYSTEMS
Moderator: Vinod Chachra
Virginia Tech

INFORMATION CENTER
Moderator: Steve Fletcher
Arizona State University

MICROCOMPUTERS
Moderator: Charles Nicholas
University of Kansas

SELF-ASSESSMENT GUIDELINES
Moderators: Sandra Dennhardt
University of Illinois
and
W. Mack Usher
Oklahoma State University

+Summary unavailable

The Information Center session was very well attended.

Members of BYYTEBAACK (see AXXESS summary) met for the second consecutive year at the CAUSE Conference.

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AXXESS (BYYTEBAACK)

Moderator: Michael Zastrocky, Regis College

Participants in the AXXESS Special Interest Session shared ideas and thoughts on the historical development of AIMS (Academic Information Management System), the primary product of AXXESS; the demise of AXXESS; the formation of BYYTEBAACK, the user's group that united to purchase AIMS from the bankruptcy trustee; and on the general rules to follow when selecting and contracting for a turnkey package.

The discussion addressed the various versions of the software that exist and how the different versions were acquired or developed. Non-AIMS users were interested in the AXXESS experience as a point of reference for evaluating products, vendors, and contracts. Participants also shared many thoughts and questions concerning the formation of BYYTEBAACK, a for-profit corporation formed by the AIMS users, and the current status of AIMS, AUG (AIMS Users' Group), and BYYTEBAACK.

Some generalizations concerning the experience were expressed by the various participants.

1. Good contracts with a vendor should protect the customer but should not pose a major burden to the vendor. (The idea was expressed that a good contract must be beneficial to both parties.) Generally it was agreed that if the vendor failed more than money was involved. The time lost had to be considered an unrecoverable resource.
2. Prospective purchasers of a product should spend time with current users and determine strengths and weaknesses of both the product and the vendor.
3. All contracts involving the purchase of hardware, software, and/or consulting should be reviewed by legal counsel.
4. A good rule of thumb says to expect to spend more time and money than originally planned on the process of selection, implementation, and testing.

Participants generally agreed that CAUSE should continue to have special interest sessions on topics involving the use of turnkey packages.

IMS

Moderator: Ralph Boe, Louisiana State University

The IMS special interest session was attended by representatives from the University of Illinois, the University of Georgia, the University of Tennessee, Virginia Tech, Tulane, and Louisiana State University. A copy of a survey developed and conducted by Sandy Dennhardt was presented, reviewed, and discussed by the group. The session was informal and an atmosphere of sharing experiences prevailed during the session. Topics of interest which were discussed included:

1. in-house development vs. purchasing packages
2. organizational structure
3. systems currently being developed and/or enhanced
4. evaluation of production systems

The session was very informative and interesting while serving as a source of encouragement for all participants.

THE INFORMATION CENTER

Moderator: Steve Fletcher, Arizona State University

There were about forty attendees at this special interest session and very active participation. About 25 percent have information centers started or nearly so. Most were planning an information center. Some had Information Resources Management structure. There was great diversity, with some doing a little third-generation programming, many doing mainframe support of fourth-generation languages, and most handling personal computers.

Of those currently running information centers, two have Nomad, two have Focus, and two have Inquire for data base access.

Some topics discussed by all:

1. What is an information center and what is it supposed to do? There was a classic mixed response.
2. What is the audience (micro/mainframe, administrative, academic)? Again, there was mixed response but most dichotomy was between administrative and academic.
3. Has the information center affected backlog? Only a few had any way to tell and those were positive.
4. Do you use chargebacks? Most thought they would use chargebacks, but most were not currently doing it.
5. What kind and depth of training is offered? Most were avoiding in-depth training.
6. Does anyone run an actual store that sells hardware and software to "customers"? Two or three did on a limited basis.
7. Should you limit products supported? There was a resounding "yes!".

INSTITUTIONAL RESEARCH AND COMPUTING

Moderators: Richard Howard, North Carolina State University
Gerald McLaughlin, Virginia Tech

This special interest session was proposed by two CAUSE members who have primary responsibility for institutional research at their institutions. The purpose of the initial session on this topic was to begin discussion about the problems associated with data integrity and its direct use by institutional decision makers and planners. Specifically, the facilitators reviewed the traditional functions of institutional research and related them to the activities of the computer center. In particular, the problems associated with data integrity were addressed.

In the past, institutional research has been primarily responsible for the analysis of institutional data bases for administrative decision making and planning. With experience, they have learned the impact of shortcomings frequently associated with the data and their implications in analysis and interpretation. As such, institutional research has provided the bridge between the hardware/software and the final user. Technological advances are now providing pathways that can eliminate the bridge. They do not, however, identify or resolve data integrity problems inherent in most large data bases nor do they insure definition stability between users, especially the novice user.

At this meeting discussions about these issues were initiated. Continued discussions are needed to develop solutions to problems inherent with inaccurate data, loose definitions, and novice users.

MICROCOMPUTERS

Moderator: Charles H. Nicholas, University of Kansas

The session was attended by about 40 people with enthusiastic participation by most of the audience. After a couple of years, the initial shock of the microcomputer explosion is leveling off. This summary will look at the areas of interest carried over from last year's session along with some new areas including Local Area Networks (LANs), Office Automation, and Word Processing.

Mainframe Communications

Interest is still high in file transfers between micros and mainframes. Kermit is becoming popular as a "standard" for communications packages accessing IBM mainframes via protocol converters. Much interest was expressed in the new 2400 baud modems, and IRMA boards are becoming very popular. A major concern in this area is security and data integrity given the ease of file transfers to micros.

Hardware

Maintenance of microcomputer hardware is still a big issue on most campuses. Vendor support and information is still poor to fair, and getting compatible parts is often difficult. A new hardware issue is that of LANs vs hard disk systems. Many people felt LANs were seldom worth the expense -- it is cheaper and easier to just buy several hard-disk systems unless you have some sophisticated data sharing or print spooling needs.

Training

Availability of training is much more stable now at most institutions. There was much discussion on how to and whether to charge for training, but no consensus was reached. Many of the newer software packages now have excellent tutorials.

Software

Quality, pricing, and dissemination of software was a hot topic. Software is requiring more memory and/or a hard-disk drive as it becomes more integrated. Most people felt software was overpriced (mildly put), and only limited success was reported by some institutions in getting site licenses. Unauthorized software duplication is still a real concern -- there is no simple answer for this although many felt vendor's pricing policies did not help matters. A lot of people compare the effort put in writing software as similar to that of writing a good textbook -- and there are not many $500 textbooks! Quite a few institutions are selling software through their bookstores. Coping with State bidding procedures and recalcitrant vendors in supplying demonstration software makes software evaluation and acquisition a tough job.

Office Automation

Although micros and the associated "word processing" software have provided tremendous relief for departmental text processing needs, it is becoming apparent that there are serious limitations. A much more integrated and comprehensive approach is being taken by many university departments as to how to automate their office processes. There is a difficult trade-off between the high cost of word processing "systems" such as Wang and NBI and in squeezing the same functionality out of micros.

OFFICE AUTOMATION

Moderator: Herb Bomzer, Fordham University

I was especially pleased with the turnout. We used a semi-structured type of meeting wherein I introduced the topic, referred to several articles in CAUSE publications, reviewed a few concepts, and called on people to comment on my statements. It was encouraging to find that people did not feel inhibited to contribute. Representatives from Penn State, Arizona State, Northern Kentucky University, San Francisco State University, Boston College, Indiana University, Virginia Commonwealth, and a few others contributed at various points. It apppears that the universities have an education program for administrative personnel.

The special interest session on Office Automation attracted about thirty-five people. The meeting was started by discussing the general definition and scope of office automation. We commented on current trends and opened discussion to individual problems and approaches.

At most of the schools, it was found that word processing is the recognized prinicpal function. At Penn State, they found that 75 percent of the word processing effort was for revising documents. Mainframe usage is discouraged because people in the office started to use DASD for storage. Penn State has utilized their local area network to train and support staff.

Virginia Commonwealth University has been looking seriously at broad fields of office automation. Communications is encouraged at VCU and other schools that are moving toward office automation. Some schools are using appointment calendars effectively. All the schools appear to have some form of education program for users. A major problem is: "How do we deal with the transition to share resources within budget constraints?" Responses to this could be the subject of future discourse.

SELF-STUDY GUIDELINES

Moderators: Sandy Dennhardt, University of Illinois
Mack Usher, Oklahoma State University

The special interest session on the topic "self-study guidelines" had almost forty attendees. Most of the people attending expressed interest in serving on the CAUSE ad hoc committee on self-assessment guidelines. The major points in the discussion were:

1. That the idea of having self-assessment guidelines is valuable.
2. That the existing guidelines published by several associations would either prove sufficient or would provide a considerable resource of information for the preparation of guidelines.
3. That the guidelines should provide a comprehensive checklist which would identify strengths and weaknesses of the organization and would help remove bias.
4. That the title "self-assessment" carries negative connotations and a more positive title should be found which would communicate a constructive attitude to organizations considering usage of the guidelines.
5. That committee members would be identified in the near future and the collection of existing material would begin soon thereafter.

Track I
Issues in Higher Education

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PLANNING BENCHMARKS FOR MIS IMPLEMENTATIONS

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Successful MIS implementation in today's college and university environment relates directly to the planning methodology employed. Both Old Dominion University and the University of Pittsburgh have recently undertaken projects to implement changes in not only their administrative systems software environments but also their hardware and operating environments. These institutions, with completely different profiles, provide examples of how planned change processes can be employed in MIS implementations. Importantly, successful implementation requires scholarship, leadership, and management skills, and the managed input of the broadly defined university communities has facilitated the success thus far.

PLANNING BENCHMARKS FOR MIS IMPLEMENTATIONS

Stimuli for Change

The continuing and rapid advances in computer hardware technology have made the age of computers a reality. Thus far the revolution has automated many industries, provided major control systems, and made it economically feasible for individuals to purchase computers with computing power equal to or greater than that which was available fifteen years ago. The forecasts for the technological future promise even greater capabilities.

With these technological developments and the translation of data management concepts into organizational and procedural realities, however, colleges and universities are confronted with an often overwhelming problem. Their existing administrative software which was designed and developed a decade or so ago is no longer efficient or effective in supporting necessary student; financial; human resources, alumni development, and facilities functions. The inadequacy of existing software has been compounded by rapid technological changes. In fact, the substantial technological developments in both the hardware and software areas make it possible for colleges and universities now to consider automated solutions which heretofore would have been cost prohibitive.

The decision to change completely the total administrative computing system and operating environment requires careful institutional self-examination. A number of important critical questions must be answered. What are the institution's needs? What are the available alternatives? What processes should be used to reach the decision about systems change? Who should be involved, and how? What implementation strategies should be undertaken? Further, a decision to change and to commit significant resources must be made in a period when higher education is facing a number of very real financial constraints and declining enrollments.

The 1970's provided substantial progress in the development and implementation of systematic planning processes and approaches to the management of institutional projects and planned change.[1] Within the higher education context, planned change is a systematic process characterized by reasonable consensus among those affected by the change. This is in contrast to an environment in which the response to change stimuli is reactionary without sufficient control and acceptance. The selection and implementation of new computer technology and administrative software in institutions of higher education provides an opportunity for applying the concepts of planned change.

Success in planned change processes requires an understanding that colleges and universities are slow to change and resistance is commonly encountered. This resistance is in part the result of the often decentralized and diffused institutional organization and authority. Further, the complexity of the college and university community confounds the change processes. Faculty groups, academic administrators, management staff all have interests to be considered and, in some cases, interests to protect. Finally, the typical responses to change--fear of the unknown, skepticism about new ideas, and pessimism regarding the probability of success--contribute to this resistance to change.

Purpose

The purpose of this paper is to discuss MIS implementation in colleges and universities as a planned change process. Both Old Dominion University and the University of Pittsburgh have recently undertaken projects to implement changes in not only their administrative systems software environments but also their hardware and operating systems environments. These institutions, with different profiles, provide examples of how planned change processes can be employed in MIS implementations.

Institutional Backgrounds

Both Old Dominion University and the University of Pittsburgh are institutions where the need for change was addressed through the use of planned change strategies. In Old

Dominion's case, a transition was made from an externally mandated requirement for change to an internally controlled planned change process. At the University of Pittsburgh, planned change methodologies were necessary to insure success after a long history of unsuccessful system development efforts.

At Old Dominion University, the need for change in administrative systems was stimulated by external forces in the form of a mandate from a Joint Legislative Audit and Review Committee. This mandate required the University to improve its accounting procedures and practices significantly. This external political and public pressure focused only on the University's accounting systems. The opportunity was seized to upgrade all of the University's administrative systems.

At the University of Pittsburgh, the stimulus for change was a long history of unsuccessful attempts to develop and implement a student information system as part of a general movement of administrative systems from an IBM hardware environment to a DEC environment. In addition, the administrative systems were located in a hardware environment that at best could be described as antiquated. Given the failure to achieve this implementation and the considerable technological changes in both hardware operating and administrative software environments, the decision was made that all systems--student, financial, human resources, alumni, and facilities management--had to be upgraded and modified to reflect those advancements and permit greater operating efficiencies.

For both institutions, decisions regarding the particular hardware environment were held in abeyance until total system needs could be identified. Earlier development attempts at both institutions first addressed the hardware environment without regard to the total software requirements of the institution. This approach to MIS implementations did not meet with general success, necessitating that new strategies be defined.

A Planned Change Process in MIS Implementations

These new strategies focused on the assessment of institutional administrative computing needs and identification of software solutions, prior to the determination of the hardware and operating environment and involved a planned change process.[2] Generally, this process involves seven steps:

(1) assessing readiness for change,
(2) identifying key change agents, advocates, and implementors,
(3) assessing and documenting the need for change,
(4) preparing a change plan,
(5) gaining consensus for the plan,
(6) acquiring needed resources, and
(7) implementing and evaluating the plan.

The stages of MIS implementation projects typically are identified as definition, development, and implementation. Interestingly, most of the effort of a planned change process as it relates to MIS implementations is consistent with what is known as the definition stage of a MIS project. In fact, the first six steps of a planned change process as identified above are synonymous with the definition stage. While the development and implementation stages of a MIS project take more time and substantially more resources, the definition stage is indeed the most critical for assuring project success. This stage not only involves the institutional assessments necessary for the project but also establishes organizational frameworks for the involvement of both technical personnel and system users.

While this planned change process appears rational and logical in sequence, these steps are indeed overlapping with considerable integration across them. Further, the human and political dynamics of the process will often influence the effectiveness of the process and its results. Their completion, however, is critical to the success of the project.

The Old Dominion University Case Study

At Old Dominion University, the Computing Activities Policy Committee was used as the forum for assessing the need and readiness for change. The Committee represented a cross-section of the University, including the Executive Vice President, as chair, representatives from each vice presidential area, the faculty, and student body. This Committee began the process of building University-wide commitment to the need for change.

Old Dominion used the accounting firm of Peat, Marwick, and Mitchell and consultants from the IBM Corporation as external change agents. As external change agents, these firms contributed to the early phases of the change process by assisting in the identification and documentation of the need for change.

Change advocates provided on-campus leadership in identifying the need for change and obtaining support for the effort throughout the institution. At Old Dominion the change advocates included the Executive Vice President, members of the Computing Activities Policy Committee, and at critical times the President of the University. Finally, a group of change implementors, those individuals who would carry out the day-to-day activities of the change process, was identified.

At Old Dominion, a director of Management Information Systems was appointed to oversee the technical aspects of the planning process and to work closely with an administrative systems planning task force. This task force also interfaced with the Computing Activities Policy Committee. A contract team consisting of vice presidential level officers, technical staff, and the University's legal counsel was established to specify the University systems requirements and to negotiate contracts with vendors. Later in the process, implementation teams for each of the three major administrative systems were created.

The process used to identify the University's systems needs involved the Business Systems Planning process developed by IBM.[3] The results of this analysis were shared widely with important University groups with the purpose of informing the University community about the nature of its information processing problems and needs. Much time and effort was expended communicating the need for substantial change and was essential in breaking down resistance and in building consensus. The planning document developed by Old Dominion provided statements of needs, objectives, and alternative strategies that were reviewed prior to determining what solution would be most appropriate. Because of the political nature of the planning and decision making process, the responsibility of developing a formal planning document was given to the Director of Management Information Systems and an Administrative Systems Planning Task Force who could be viewed as credible professionals.

After developing the plan, the shaping of consensus among various constituencies at the institution required numerous presentations, meetings, and confrontations. For Old Dominion, this included administrative systems users, selected departments and operational offices, academic deans, selected committees of the board of visitors, the State Secretary of Education, the State Department of Management and Administrative Systems Development, the State Comptroller, and the State Auditor of Public Accounts.

The acquisition of needed resources for the project required extensive budgetary reallocations to guarantee the availability of necessary resources over a five year period. The support of the President and Executive Vice President was essential in gaining both the community and resource support.

After gaining support, an implementation plan was developed and was organized around each of the three major systems to be implemented: the student, financial, and human resources information systems.

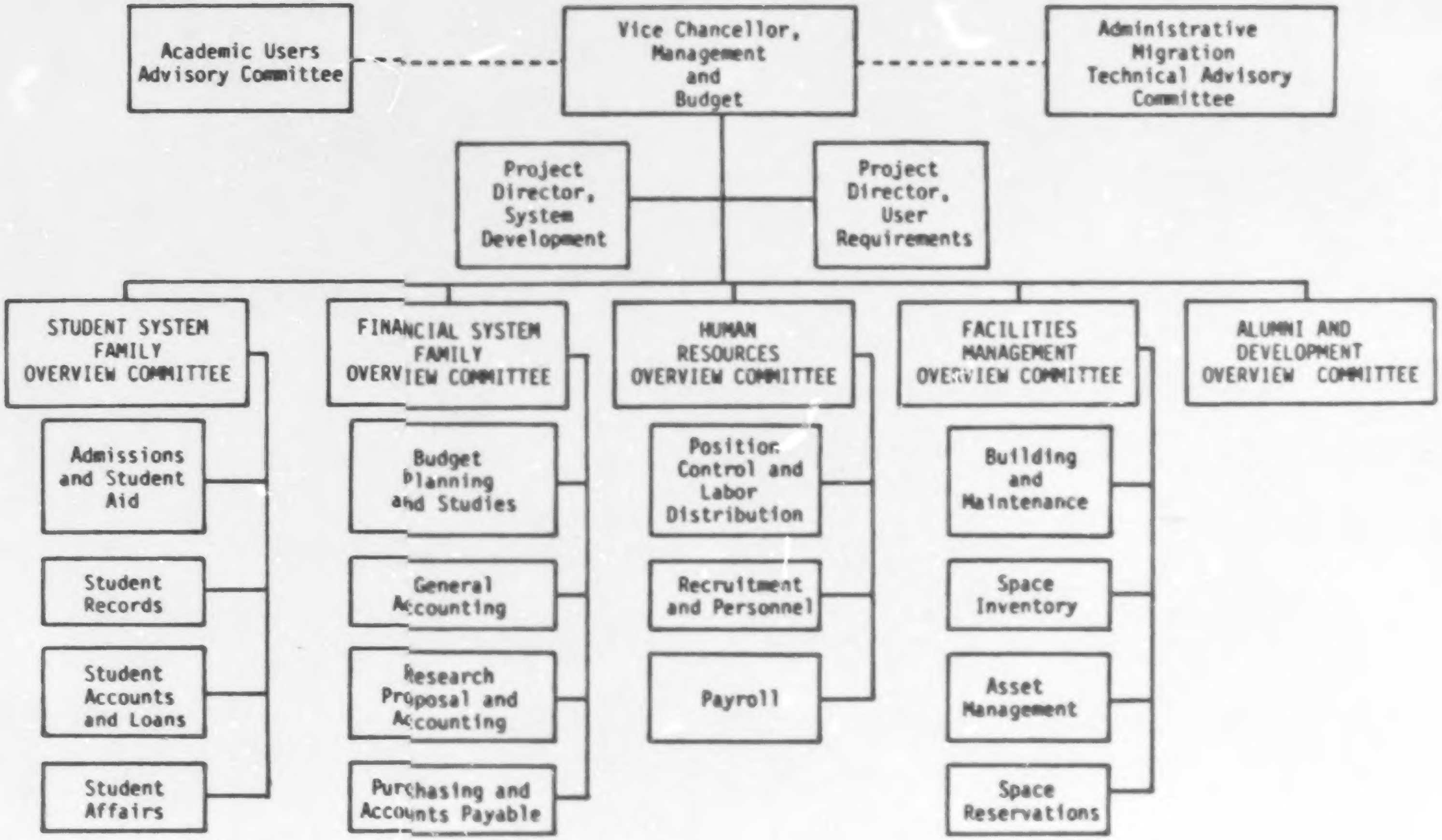
The University of Pittsburgh Case Study

Unlike Old Dominion University, the University of Pittsburgh did not formally assess the institution's readiness for change. Informally, however, recognition was given by senior management. After several unsuccessful attempts at moving administrative systems software from one environment to another, the mandate was given for the institution to succeed in implementing the necessary changes. Key to the University's process for planned change was the identification of the actors for change and organizing them appropriately into the process (Figure 1).

Internally the key change agent was the Vice Chancellor of Planning and Budget. His role was to define the problem, collect

Figure 1

Organization for Migration Project Management


Academic Users Advisory Committee
Vice Chancellor, Management and Budget
Administrative Migration Technical Advisory Committee
Project Director, System Development
Project Director, User Requirements
STUDENT SYSTEM FAMILY OVERVIEW COMMITTEE
Admissions and Student Aid
Student Records
Student Accounts and Loans
Student Affairs
FINANCIAL SYSTEM FAMILY OVERVIEW COMMITTEE
Budget Planning and Studies
General Accounting
Research Proposal and Accounting
Purchasing and Accounts Payable
HUMAN RESOURCES OVERVIEW COMMITTEE
Position Control and Labor Distribution
Recruitment and Personnel
Payroll
FACILITIES MANAGEMENT OVERVIEW COMMITTEE
Building and Maintenance
Space Inventory
Asset Management
Space Reservations
ALUMNI AND DEVELOPMENT OVERVIEW COMMITTEE

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and interpret information, and serve as a catalyst and mediator throughout the process. To serve as change advocates, two key advisory committees were developed. The Administrative Migration Technical Advisory Committee (AMTAC) included members from the senior and vice presidential offices, including the Provost, the Health Sciences, and Business and Finance, and from the University Computer Center. Because of the potentially substantial impact across the remaining University community, particularly relating to academic policy and practice, the Academic Users Advisory Committee (AUAC) was formed with representatives from each of the dean's offices of the University, as well as the four regional campuses.

Change implementors involved a variety of formal organizational roles. Project co-directors were appointed--one from the technical perspective and the other reflected the user community. For each of five administrative system areas, overview committees were established and charged with the responsibility of identifying system needs, as well as assessing various software solution alternatives. These overview committees included primary user offices, as well as faculty representation from the University Senate on Computing. These overview committees were further organized into appropriate sub-committees, and membership there was allowed to expand to accommodate the particular needs at any given point in time. In total, the planned change process during this definition stage involved over 270 individuals of the University community.

The first task of an overview committee was to develop a requirements document which summarized for each system family the general user needs and technical requirements. These requirements documents were reviewed by member of both AMTAC and AUAC for any comments and served as a vehicle for internal discussions and consensus building. In addition these documents served as a basis for examining alternative software solutions, focusing principally on possible vendors and involving extensive analysis.[4]

On the basis of the evaluations made throughout the investigation of software alternatives, the Vice Chancellor for

Planning and Budget developed recommendations regarding the procurement of administrative software which set into motion related activities associated with the hardware and operating solution. Gaining consensus regarding those recommendations had been developed throughout the process of developing the requirements documents and the assessment of software alternatives. Given the acceptance of the recommendations and the commitment of University resources, implementation planning proceded focusing on the specific activities associated with the development and implementation stages typically conducted in a MIS implementation.

Summary

Institutional change will occur whether one plans for it or not. The importance, however, of planned change when implementing major MIS systems cannot be underestimated. One principle benefit is the development of a deep commitment to the identified solution. Importantly, successful implementation requires scholarship, leadership, and management skills. Because the characteristics are essential for a planned change activity in a college and university environment, a team approach is almost mandated. At both Old Dominion University and the University of Pittsburgh, the change agents, advocates, and implementors incorporated these characteristics into their organizational framework. The managed input of the broadly defined university community facilitated the successful outcomes achieved thus far. Complementing the organizational framework was the commitment and involvement of senior management of the institutions. Finally, both institutions relied on their scholarship in the thorough documentation of the problem, needs, and solution as a mechanism for promoting discussion, consensus building, and arriving at a final decision.

Footnotes

[1] J. W. Moore, et al, "Administrative Systems Reform through Institutional Commitment and Planned Change," Paper presented at Association of Institutional Research, Fort Worth, May 1984.

[2] G. M. Hipps, Effective Planned Change Strategies (San Francisco: Jassey-Bass, 1982).

C. A. Parker, "The Literature on Planned Organizational Change: A Review and Analysis," Higher Education, July 1980.

[3] F. H. Wise, et al, "Selecting System Architecture, Technology, and a Vendor for Information Systems," Paper presented to Association for Institutional Research, Fort Worth, May 1984.

[4] C. A. Linhart and J. L. Yeager, "Planning and Managing the Administrative Software Selection Process," Paper presented to International Society of Educational Planning, New Orleans, October 1984.

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The Expected Stranger-Computers On Our Campus for the First Time

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This paper discusses some of the major issues and problems faced when installing a computer system on a college campus for the first time. Philosophical and practical concerns relating to initial installations of an on-line administrative database are highlighted. Suggestions which may contribute to a smooth installation are given. Primary focus is on the need for continuous user education and involvement in the vendor selection process. Adequacy of traditional criteria for sizing a computer system is also questioned.

Introduction

This paper was originally planned to present a balanced historical and present view of the installation of a computerized Management Information System (MIS) at Barnard College. As I attempted to fill in the outline of the paper it became clear that the historical components were of little interest to most people still at Barnard and would be of little use to planners at other colleges. A description of the mistakes made at Barnard and suggestions on what could have been done differently to make the present management information system (MIS) implementation smoother is perhaps the most useful presentation to those of you attending this conference or reading this paper. This will result in highlighting what (in hindsight) some will view as errors. I would like to thank my colleagues at Barnard and the institution for allowing me to take this approach; for being strong enough to be held up to such scrutiny and review. In fact, the project is an ongoing success. As you will see in the retrospective part of this paper, success is actually causing some of the problems which in hindsight I will be suggesting preventative actions for.

The major topics covered involve the general philosophical management approaches an institution decides to take with regard to computerization. Impact of conscious and unconscious decisions on staffing, training, conversion from timesharing and growth from a transactional information system (TIS) to a management information system (MIS), with decision support and office automation, will be highlighted.

Staffing/Philosophical Decisions

An easily overlooked fact is that staffing decisions when an MIS area is being set up are the key determiners of the direction a computerization effort will take. If high level management communicates differing philosophical positions regarding staffing it likely indicates different views and perhaps a serious ongoing conflict around how computerization should proceed within the organization. This conflict may not even be consciously stated. In the Barnard case, some conflict was indicated when job descriptions were being prepared. Unfortunately what appeared to be easily reconciled differences between a new MIS director (myself) and the vice president in charge of computerizing the institution was an indication of institutional uncertainty as to what an already signed computer contract meant.

The rapid institutional timetable for computerization forced a decision that value change would take place during training. Time demands that alternative methods of reaching consensus would have required everyone at the college and the psychological literature on value change ranging from Gordon V. Allpert to J. Jenkins support this decision. Research dating back to World War II on changing values shows that training and actual behavioral practice would be more likely to bring about attitudinal change than a brief educational program. The alternative would have been to have a great deal of expensive hardware and software sit around while an extensive and time consuming education program was instituted; followed by user training. Disadvantages appeared to exceed the advantages of this alternative.

The college had contracted for an integrated set of application packages which work with a flexible relational database for on-line inquiry. While the philosophy of the vendor clearly follows an information center approach this does not appear to have been clear at the college. This was evidenced by an initial direction to hire staff with large system programming experience. Discussion of issues led to what I strongly feel were the correct staffing decisions. The Barnard MIS area is staffed with professionals from a variety of disciplines, each with enough computer related skills to quickly learn the purchased system. Staff also have an understanding of higher education and skills necessary to be effective trainers and office systems analysts.

Once staffing appropriate to the information center concept was established, the pressure of a very rapid implementation schedule made it easy to ignore the signs that the institutional analysis, RFP stage and final vendor selection had not led to an institution-wide acceptance of what was to follow. The new computer center and MIS staff were indeed strangers in the midst of a venerable institution. Computerization began with support from the president. The decision was made that understanding and acceptance of what a unified database and information center approach would mean for individual offices would be achieved through training for and installation of each applications module.

I am emphasizing the importance a shared institutional understanding and acceptance of a program that brings changes to most office's operations. The changes I refer to are widespread as data processing support for organizations moves from back-room, batch, powerful record keeping operations to on-line, interactive systems. While the newer systems give users direct access to their information greater user responsibility for accuracy and coordination is demanded.

Barnard managers have been faced with leaving a service bureau whose use grew slowly as needed to solve specific problems, for a complex system the need for which may be difficult to see from any but a top level institutional view. Following is a list of some of the changes faced by Barnard managers:

1. The service bureau was able to respond to the needs of an individual office without worrying about other offices. With integrated applications internal MIS staff must carefully consider the entire system and may not be as responsive to individual offices.

2. The service bureau employed a data input staff and converted data from each offices hand filled forms. The Barnard computer center does not employ data input clerks but expects each office to enter their data through CRT´s.

3. No effort was made to avoid duplicate data entry nor to produce reports which cut across office areas with the service bureau. The integrated application packages aim to do both. This requires changed procedures and increased office interdependence.

4. User offices were not expected to have any interaction with computers with the service bureau. With an in-house system not only must Barnard staff use CRT´s but they are expected to learn the data retrieval language. Where before a user office would authorize an exchange of computer tapes between service bureaus now the user office, with MIS staff assistance, is expected to take a direct part in controlling the exchange of data.

Perhaps the most difficult change is that the new MIS area or "stranger" must be consulted before certain types of changes in procedure may be made. It is no longer possible for an office manager or even a vice president to make changes in their area without considering the impact on computer services provided to other offices.

These changes are the result of installing a state of the art integrated database system. They would be the same if the applications packages were being developed internally or, as in Barnard´s case, purchased from an outside vendor. Compromises made for successful internal development of integrated applications packages end up being no different than compromises needed to install vendor supplied packages. The difference is the speed of installation and the cost.

Although some of the signs that the "stranger" was not fully anticipated were not clearly seen the installation at Barnard is going smoothly. After discussing some more of the decisions made at Barnard I will attempt to use hindsight to make suggestions which may help others in the future. Once a system has been decided on an interaction between vendor and institution must take place to develop training and implementation plans.

Training Users

Barnard College chose a mix of in-house and vendor assisted training. With an MIS director and database administrator who were familiar with the software it was possible to do the majority of training and education with internal staff. Datatel Minicomputer consultants arrived on campus towards the end of the installation process for most modules, to establish a presence on campus and answer final user questions in person. Training started with office directors and supervisory staff. In some cases vice presidents participated in the more educational initial meetings, and stopped attending as the meetings moved to technical training and decision making. As table files and support codes were defined training expanded to include clerical data input staff and office directors phased out of the training. As soon as the first offices were approaching the end of the applications software installation process a short twelve hour course was started to teach users how to use Prime Information; the database query language. This course is now being given monthly. Attendance is limited to five participants to allow individual attention and the level of attendees ranges from vice presidents to clerical staff.

While Barnard has done most of the training in-house. the usual approach is to have more vendor involvement. A purchaser of the applications packages will usually send MIS and user staff to Datatel for regularly scheduled classes covering each of the modules. These trained staff will then run similar training sessions back at the institution.

At Barnard we believe that education and training is an ongoing process necessitated by changing staff, changing levels of expertise, new releases of the operating system and new releases of the application packages. To accomodate this process it is necessary to have a permanent part of the computer center dedicated to training even though it is difficult to tie up scarce CRT and space resources for an important yet part-time activity. One approach is to make the training area serve a dual function. With an on-line system it is somewhat wasteful to give each office enough CRT's for peak data input times. At Barnard the training area is also used as a peak period data input area for the college. It is also used for computer user group meetings and its terminals are "loaned" out for registration periods or should breakdowns exceed a reasonable number of spare terminals. This multi-functionality ensures that the training area will not be questioned as having too large a share of resources allocated to it.

Education cannot be emphasized enough. We are all from organizations whose primary product is education. Yet, I fear that we frequently ignore educational principles when dealing with staff, faculty and administrators. If we were to go to the education, psychology and remedial education groups on our campuses we could distill the following; learning takes time, learning requires motivation, learning requires a suitable environment, and learning requires a certain level of freedom from distraction.

To varying degrees the MIS staff has been able to follow these principles at Barnard. Although I decided that it was necessary to go right into a training mode early meetings provided time for some general education and presentation of organizing concepts. It is important that MIS staff give users concepts to organize the new learning which is expected of them. Equally important is the need to organize the new learning which is expected of them. Training needs to be organized in an increasing spiral of complexity. Trainers need to be patient and wait for understanding to occur. You should be aware that understanding will usually happen after users have been using a new system for six to twelve months. A title for another paper or perhaps a whole book might be "Zen and the Art of User Training." Careful attention to user training and consideration of the major changes expected of users may help minimize the resistance usually encountered.

Conversion from the Service Bureau

Barnard's use of a remote service bureau had grown without central direction over a number of years. There was no central Barnard repository of information relating to the computer services being received. Rather than expend a lot of resources to define a process which would soon be ending, it was decided that each office would be responsible for defining what data would be moved from the service bureau and exactly where it would be placed within the new database. MIS staff then wrote necessary conversion programs and did preliminary testing after data conversion. Problems have occurred in this process. However, it appears that the problems have been no greater than if extensive resources had been focused on defining the total existing system prior to conversion.

A caveat that must be followed with this approach is never to discard any data; no matter how strongly the responsible person in the user office says that it is not needed. It is likely that some piece of data will suddenly be wanted; or needed. Another possibility is that an office not involved in computerization will have had data stored with the service bureau and that this will be forgotten by those involved in the software installation. In fact, both of these possibilities occurred at Barnard. We were able to "recapture" data for two offices which are not involved in the on-line computerization process only because we had loaded all tapes from the service bureau onto the Prime computer.

Another caution is to have the service bureau maintain all records on tape for at least six months after offices are live on the new system. The tapes should be stored by the institution with sufficient documentation as to the contents of each tape so that they can be used by the institution if needed. There is likely to be information stored in machine readable form which during the throes of initially starting to use an on-line system an office will say they will never want to backload onto the system. After new procedures have become routine and things settle down the institution will likely want to be able to backload all information which is in machine readable form. An example under present consideration at Barnard College is historical transcript information. Like financial data, transcript information must be carefully checked and audited when moved from one software system to another. At Barnard backloading of transcript information is complicated by the nature of the services previously provided to the registrar's office. Initial transcript labels were machine generated;

grade changes and completion of incompletes were not sent to the service bureau. Thus, every transcript record which is entered from historical tape must be called up on the on-line system and corrected. During the throes of introducing an on-line system to the Registrar's operation sufficient attention cannot be devoted to the task. It appears that either plans have to be made before the stranger arrives or after the new computer system has been installed and operations have settled into their new routines.

Expectations of Users for Service

The Barnard experience of bringing a new computer system to the campus for the first has also been greatly affected by the promises of vendors and public media advertising of computers. Expectations were raised to a high level during the vendor selection process without a commensurate look at the difficulties involved and areas where expectations are too high. We experienced three main areas of high expectations: quantity of letter quality sheet and envelope printing, that the majority of staff would have computer terminals, and that a manager could ask for any kind of on-line report at any time.

User expectations for letter quality sheet and envelope production exceeded the capabilities of the resources (hardware and staff) available. When with adjusted procedures and slight lowering of standards (using continuous form or tipped-on envelopes) it was possible to produce the volume asked for we found that it could not be handled by the office services area which was used to processing standard envelopes using heat sensitive cheshire labels. In the midst of everything else it was necessary to get users openly discussing their mailing needs with MIS staff and with Office Services staff. While the answer to can they have quantity letter quality output is yes from a technical standpoint the answer to may they have it might sometimes be no from an office services and computer operations staffing point of view. One option that deserves attention is giving several high demand offices a fairly fast correspondence quality dot matrix printer for envelopes or the soon to be released 90 CPS daisy wheel printer; with staffing provided by those offices needing the printed material.

In addition to CRT's being status symbols, an on-line system does require more data entry and query stations than a batch system. In drawing up system specifications it is important to realize that computerization will only have a minimal impact on clerical data input work. Where computers save effort is in the recall, reporting and reorganization of already entered data. Thus, if an office has five full-time clerks recording data on index cards or filling out data entry forms for a service bureau an on-line system will require at least five terminals plus an additional two or three for management inquiry. The only possibility of minimizing the number of terminals needed is to change staff working hours.

The "terminal as status symbol" drain on resources can be resisted during initial system implementation. However, the more rapidly implementation proceeds and the database is built the faster a lack of terminals and software for managers becomes a hindrance to an institution. Requests for executive terminals (which a system planner is often advised to ignore) will soon become real needs if an installation is successful.

Another draw on limited resources which is also frequently underestimated by institutions installing their first on-line system is the MIS area. The more rapid an installation required the more resources and terminals will be needed for MIS staff and user training and support. The reality is that it is rare for an institution to be able to afford an interactive terminal for every staff person who might use it during the day. Each terminal if turned on creates some drain on the overall system. If a terminal is used for data input the load it causes increases and if it is used for ad hoc inquiry and reporting the load can skyrocket.

There is a fine line between telling user offices that something is technically possible but for one reason or another their request cannot be satisfied. It is a difficult decision to decide how far to stretch resources to meet expectations, when to try to change expectations and when to push to modify/expand resources to come closer to meeting expectations. Barnard College is now in the process of solidifying its new administrative system. Rapid growth has shown that the mistakes enumerated above occurred to varying degrees. Administrative computer resources have almost reached their limit. A freeze on new applications is being contemplated until an upgrade of the CPU, additional memory and more communication lines are budgeted for.

Management Information and Office Automation

There is another component to the Barnard story. Before the hardware and software for the on-line system arrived Barnard was thinking ahead. A desire for a uniform administrative approach to word processing was being analyzed with the hope that it could be integrated with the new database. Four months after the main administrative system arrived a decision was made to purchase microcomputer word processing stations from the same vendor, Prime Computer. We are able to easily move documents and information lists from the host database to the Prime Producer workstations. In addition to full word processing these stations contain the Multiplan spreadsheet program and the potential to run other popular programs. As the administrative database grows and it becomes possible to use it for management analysis it is our expectation that these workstations will be used for "what if" types of analyses and to do cosmetic polishing of management reports. Both activities would otherwise become a major drain on central CPU resources. These workstations can also be clustered among themselves for sharing files, a capability which may be used to further reduce the load on the central system.

Software presently being developed will allow these workstations to function as full terminals with the Barnard administrative software. When the central system is expanded the stand alone workstations can be attached and used for data entry, retrieval and the office automation functions of word processing, spreadsheet analysis, calendar/scheduling and electronic mail.

Few people at the college know that we have these capabilities in reserve. There is just so much technology that one institution and a relatively small group of people can absorb at one time; and installation of the administrative database has priority at Barnard. There is also no point in raising expectations if the central CPU is not upgraded to have the capacity to serve as a central file server for office automation (OA) functions without compromising support to database users. I do not subscribe to policies which would lead to crises or forced management decisions. I believe that a policy of letting system use grow until an upgrade is forced should not be followed. When I know that an appropriate system upgrade has been planned I will consider starting an educational and training program covering the OA functions. This time I hope to take the luxury of enough time to repeat a brief needs analysis in combination with an education process conveying what is available. From this process I will assess the readiness of staff at the college for further technological change. I will also determine which OA functions should be introduced first, who will be included in training, and a time frame for training and use of the new systems.

Hindsight/or What it Would Have Been Nice to be Able to Do Differently

It is obvious from earlier sections of this paper that I would have liked to see more user education as to what the "stranger" on campus would mean. There appears to have been sufficient user involvement in the initial needs assessment phase of the project. There was also user involvement in vendor demonstrations. User involvement ended at the point of final vendor negotiation and did not start again until training started on each module. Although there would have been some degree of risk that users would have delayed a decision, more open discussion of the pros and cons of the final vendor would have helped prepare office managers for what was to come. Before signing a contract with a vendor I recommend trying to let users see the bad and the good along with a "nitty gritty" discussion of the different approaches which can be taken when installing and running the proposed new system. Although I suspect that consensus will not be reached by users the process will provide needed education to users and to the MIS staff. Acceptance of a final plan, either by Presidential edict or consensus will also be improved. User resistance exemplified by statements such as "I was never told" or "My needs were never considered" will not be acceptable. Education regarding what to expect from the new system should continue after a course of action/philosophical approach has been decided on until software and/or hardware arrives. At that point limited resources need, of necessity, to be shifted into a training mode.

During the sizing of the system careful attention needs to be given to an institution´s organizational chart and clerical staffing pattern. The traditional approach of giving most weight to physical size of archival and transaction files when determining system needs does not seem appropriate when designing an on-line interactive system. Use of an organizational chart with detail carried down to the actual clerical level is the place to start. If one indicates the actual data handled by clerks and the computer system files used along with working hours it appears possible to accurately predict terminal needs and estimate system load. Part of this process would include having office directors compile lists of reports generated including: data elements, frequency, who asks for it, is special paper needed, how many pages are expected and how soon after it is asked for is it needed. The final steps of this process needs to be done when vendor selection is down to one or two finalists, since it is highly dependent on a particular system´s file structure and data input screens.

THE ELECTRONIC CAMPUS OF THE FUTURE

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The University of Alabama in Huntsville has made a bold, innovative commitment to a mainframe-based microcomputer network. This paper discusses the strategic planning effort, organizational structure used for network integration into classroom, office and research activities, and a critique for enhanced replication in subsequent phases or similar undertakings.

At a cost of $12 million, jointly funded by the University and a generous gift from the Sperry Corporation, Project ACCESS is exploiting technology while advancing the University's mission. This project has created considerable excitement among the faculty and students and is stimulating a fresh look at the curriculum as well as focusing on overall campus communications.

THE ELECTRONIC CAMPUS OF THE FUTURE

For years we have heard and asked the question, "WHY DID THE CHICKEN CROSS THE ROAD?"

The hackneyed responses have ranged all the way from "BECAUSE IT WANTED TO GET TO THE OTHER SIDE" to "BECAUSE EVERYONE ELSE WAS DOING IT."

Coincidentally, this response range is all too applicable to the question, "WHY IS THE CAMPUS AUTOMATING?"

While there continues to be philosophical speculation on the matter of why the chicken crossed the road, there is a clear shortage of practical planning, organizational and political models for addressing the larger stumbling block, "HOW DID THE CHICKEN SUCCESSFULLY CROSS THE ROAD?"

Similarly, the HOW of campus automation and concomitant policy, political and organizational models are in short supply. This paper reviews the following issues and their resolution at The University of Alabama in Huntsville (UAH).

* WHY DID UAH CROSS THE ROAD TO A MAJOR COMMITMENT TO AUTOMATION?

* HOW DID UAH CROSS THE ROAD TO AUTOMATION?

* HOW SUCCESSFUL ARE WE TO DATE?

IN THE BEGINNING. First, a little background on The University of Alabama in Huntsville will serve to set the stage for our automation saga. Throughout the 1940's, the Huntsville community attempted to convince The University of Alabama to establish an extension center there. In 1950 the Huntsville Extension Center of The University of Alabama was established.

The arrival in Huntsville that same year of Wernher von Braun and his German rocket team spurred the growth of the city and the Extension Center. Within two years of his arrival, the Army Missile Command at Redstone Arsenal was established at Huntsville. Among the other scientific and strategic agencies attracted in part by von Braun's rocket team and related activities were NASA's Marshall Space Flight Center, Ballistic Missile Defense Command and the Missile Intelligence Agency.

When the Soviets presented the world with Sputnik in 1957, things in Huntsville took off and have never really stopped. It was clear that a strong university, high quality medical care, and a broad offering of cultural programs and the fine arts would be necessary to support a large and growing professional and scientific community.

Numerous high tech companies have spun off from the space and missile programs, locating in the research park and elsewhere in the region. An increased level of university activity was required to support the community, and von Braun personally led the charge for the establishment of the Research Institute on the campus in 1961.

On September 4, 1969, UAH became an autonomous institution and equal partner with The University of Alabama and The University of Alabama in Birmingham.

UAH is located on a 332 acre tract of land in the Cummings Research Park. This research park is the second largest and most populous in the country. The University's headcount enrollment is 6000, more than half of whom are employed in the community. The University's annual operating budget is $48 million.

The use patterns and growth of computing at UAH could be characterized as traditional. The combined data processing and computing center houses a Sperry model 1100/70 as well as specialized graphics and other research equipment. Sperry large-scale computing equipment is rather common among the scientific community in Huntsville.

PROJECT ACCESS. During the Winter of 1983 and Spring of 1984, three rather independent events converged in a most fortuitous manner for UAH: 1) the University was considering alternative strategies for upgrading the integration of computers in all of its activities; 2) the Sperry Corporation was looking for a potential higher education partnership with which it might showcase a broad range of computer products; and 3) the State of Alabama was preparing to give UAH a 29% appropriation increase.

The convergence of these three activities led to the initiation of Project ACCESS, Advanced Comprehensive Computer Educational Service System, a joint commitment by UAH and Sperry of $12 million over a three-year period. The needs of the University were successfully represented in negotiations with the Sperry Corporation by UAH's Executive Director for Institutional Advancement. The final agreement between the parties divided the project as follows:

> UAH Responsibilities: Prepare appropriate site and other necessary accessories (furniture, networking devices, phones, etc.) for the donated and discounted equipment; purchase approximately $6.5 million in hardware, software, and maintenance from Sperry; provide two full-time qualified support employees; train personnel to support the products delivered; and provide workspace for "over the counter" maintenance.

Sperry Responsibilities: Donate $3.2 million in host upgrade equipment; provide other equipment at substantial discounts; make available product education services; and provide maintenance at approximately one-half price for personal computers. The estimated value of the Sperry gift is $5.5 million.

The sole purpose of Project ACCESS is to exploit technology while advancing the University's mission. The primary objectives of the program are:

1) Increased user interest in, knowledge of, and application of computer and related technologies;

2) Integration of computer and related technologies into a sophisticated network, to enhance teaching, research and public service;

3) Optimization of a broad range of automated applications across the micro to mainframe spectrum;

4) Increased user comfort with and command of an automated environment enhanced by fourth generation languages operating in a network of microcomputers, mainframe-based and distributed information systems, and office automation systems.

PLANNING. The general scope of the project was defined by a committee comprised of faculty and administrators who began by creating a forward-looking "wish list" for computing services and equipment on campus. Over a period of nearly six months, meetings and hearings were held to develop a service and equipment schedule. Two primary factors worked to keep these lists relatively realistic: 1) the operating general fund line item is budgeted to the academic schools (cost centers) which are actively involved in the generation of overhead formulae used to fund support services, including computer services; and 2) each installation was to be monitored to determine the level of use both on the network and in the curriculum or operations. Consequently, the project was funded at between 80-90% of the original requests.

Three planning/implementation committees were subsequently formed.

> Academic Users Committee - This committee, chaired by the Director, Project ACCESS, establishes software standards such as Wordstar Professional, dBase II, Supercalc III, Lotus 1,2,3 (limited), Minitab, SPSS, and other packages. This committee also receives and considers proposals from the Deans regarding the placement and uses of PC clusters. Additionally, policies related to release time for courseware development, software copyrights, continuing education

for faculty and staff and PC lab security are developed.

Office Automation Committee - This committee, chaired by the Vice President for Finance and Administration, is comprised of eight senior staff assistants representing all of the major operating divisions of the University. It considers issues related to office needs and installation priority, training strategy, learning the full range of capabilities of the system, and planning seminars and informal consulting/learning opportunities for all users of office automation equipment.

Advanced Languages and Data Resource Committee - Among the gifts from Sperry are several distributed processors. The principal Sperry product chosen by UAH for use on these processors and the mainframe is MAPPER, a powerful fourth-generation system development, query and data base tool. This administrative committee, chaired by the Vice President for Finance and Administration, deals with such issues as system development priority, system development standards for users, and policies governing distribution, and access and storage of data.

These three committees are coordinated by an Executive Steering Committee chaired by the Vice President for Finance and Administration, and including the Vice President for Academic Affairs and the Director, Project ACCESS. This committee meets each week to review progress and to resolve policy issues.

Currently, network planning is being accomplished through the Vice President for Finance and Administration, the Director, Project ACCESS, the Director of Communications Services, staff in the Computer Center and a representative from Sperry.

Although having a single vendor bearing a multimillion dollar gift as a partner does simplify certain issues, many remained to be resolved.

ORGANIZATION. To what extent is it reasonable to expect senior line administrators to augment their normal day-to-day activities with a major commitment of time over several years to implement a project like ACCESS? Since we were unable to offload significant responsibilities from such already overworked personnel, the answer appeared to be that prolonged effort, commensurate with the importance of the project, was an unreasonable expectation from such personnel.

A second important question is, "To what extent do years of operation within a set of policies and parameters interfere with an institution's ability to break those habits and implement a new vision with implications of change for everyone in or touched by the institution?" It was our conclusion that a "fresh resource" was needed to lead the institution through this change.

The response to these and many other questions was the establishment of the position, Director, Project ACCESS. The position was integrated with the existing organization under the following guidelines:

1) The position has a reporting line to the President;

2) The Vice President for Finance and Administration is responsible for integrating Project ACCESS into the existing computer services offered by the Computer Center;

3) All personnel (other than the director) necessary to support Project ACCESS (Sperrylink coordinator, Mapper coordinator, network coordinator, PC coordinator) are to be integrated into the Computer Center staff;

4) Coordination with line operations is maintained through the Executive Steering Committee.

This arrangement created a moderate level of tension in the organization. This was not only predicted, it was considered desirable by those involved in organizational planning. The issues tended to move away from day-to-day operations and focus instead at the policy level. While the organization must deal with many political issues, we were determined not to allow the fire of this project to be lost in the smoke.

THE POLITICS OF CHANGE. What forces at work in an organization are most likely to impinge on the implementation of change? We are all familiar with some of the more positive forces such as integrity, loyalty and self-preservation. However, there are other strong forces at work impeding change. Among these are several forms of stress.

One such form is the stress created by moving away from a known situation, place, or process with which one is comfortable. Closely related is the stress associated with moving to an unknown situation, place, or process where one's ability to succeed is unproven. Simply stated, significant change may both confront, and be an affront to, long-standing assumptions, customs and work habits of operating personnel. Concepts and talents with which reputations were made are being revalued or displaced.

Another factor at work in change is an organization's tendency to smooth the plot of the change curve. By the time this curve works its way through the organization, the intuitive future may well have been compromised by the more popular past. This is not surprising since measurement of individual performance is often based on the ability to survive in today's operating environment rather than on the ability to create and accommodate change.

The effort at UAH to reduce personnel anxiety related to technological change centered on three actions: 1) repeated expressions of strong commitment to Project ACCESS from the President and members of the executive staff of the University; 2) a sizable commitment to a broad range of introductory and software-specific continuing education programs for all interested faculty and staff; and 3) the appointment of a Director of Project ACCESS outside of the line organization in order to minimize organizational compromise of project momentum.

It must be added that making a $12 million decision had the salutary effect of convincing most rational people that the University was serious in its commitment to campus automation.

HARDWARE. While there are literally thousands of pieces of equipment involved in Project ACCESS, the following is a summary thereof.

- 610 microcomputer systems (IBM PC compatible), 256-512K, most with high resolution color graphics and printers
- 2 additional processors on the mainframe (tripling current capability)
- 75 Sperrylink Office Automation systems
- 60 dumb terminals
- 100 printers
- 2 communications processors
- 3 MAPPER systems
- 2 language processors
- 2 distributed office processors
- 1 Voice Information Processing System (VIPS)
- Various multiplexors and other equipment necessary to tie all of the above into the mainframe and for other networking purposes

The PC's are being dispersed approximately 60% in class labs and student use areas, 30% among faculty for use in courseware development and research, and 10% in support service areas.

SOFTWARE. As noted earlier, Project ACCESS provided a basic set of standardized software to all users. Training on all such software was made available to all interested faculty and staff. The decision to network some PC labs to the mainframe was accelerated when it was determined that the acquisition cost avoidance by using mainframe-based software such as Minitab and SPSS offset most of the communication related costs. Excellent quantity prices were negotiated with software companies, and in some cases the decision has been made to standardize on freeware.

The purchase of other than standard software is an option available to each operating unit. The two requirements precedent to such acquisition are: 1) it must be cleared with the user services office in the Computer Center to verify its compatibility with existing operating and user software; and 2) licenses for all purchased software shall reside in the Computer Center in an effort to coordinate legal matters, maintain a directory of all software on campus, and centralize problem-solving experience.

Release time, consulting support and faculty seminars have been used as incentives to the development of courseware and the integration of the computer into the curriculum.

RESOURCE NETWORKING. At UAH, we do not generally suffer from an information overload; we do suffer in some areas from a data overload. While many of our support systems are quite advanced and sophisticated, other opportunities remain quite unmined. Thus, the question arises, "In what patterns do we couple our hardware and software tools in order to best serve our human engineered organizations?"

In his foreword to an Infosystems article, internationally acclaimed John Diebold (June 1979, p. 51) quotes Wolfgang von Goethe, writing in 1810:

> The modern age has a false sense of superiority because of the great mass of data at its disposal, but the valid criterion of distinction is rather the extent to which man knows how to form and master the material at his command.

Three primary network alternatives have been selected for campus communications.

In the first alternative, some PC class labs are being networked via a building multiplexor through a Distributed Communications Processor (DCP) to the mainframe. This technique accommodates PC-based software as well as mainframe-based software. This technique is also quite prevalent among our dumb-terminal clusters placed throughout the campus.

The second network technique is the LAN. In some PC class labs, a master PC with appropriate servers is inserted into the PC loop. The savings in shared software, through special licensing agreements, and reduced personnel overhead represented in reducing or eliminating floppy disk libraries in the lab, generally fund this networking system. Similarly, we are planning to install two distributed processors as LANs with a bridge to the mainframe network and two stand-alone language processors.

The third communication technique is quite traditional. The office automation network (Sperrylink) is essentially mainframe based. The terminals (PC based with dual-sided, double density disks) are connected to the mainframe in the least expensive manner available (direct, multiplexed, phone lines, or DCP). All switching and document sharing is accomplished through the host. The Sperrylink terminals handle traditional office automation functions, provide access to administrative files (both host and distributed processor-based), and serve as programming and query terminals for MAPPER applications.

The primary network being installed is Telcon, housed in a Sperry Distributed Communication Processor (DCP). This network supports the Sperry 90 and 1100 series, as well as non-Sperry hosts. It further supports all Sperry terminals (intelligent and non-intelligent), Teletype 33/35, and IBM 3270 and 2780/3780 modes. Network management and security are provided in the remote batch, transaction, demand, message switching, and distributed processing operating modes.

The Telcon system supports Universal Data Link Control (UDLC), synchronous, asynchronous, and bisync modes of communication, as well as certain bit-oriented procedures. The network further supports the X.21 and X.25 protocols useful in bridging to public value-added networks.

The Voice Information Processing System (VIPS) is a new product designed to increase telephone efficiency by reducing calls-not-completed and telephone interruptions, and neutralizing such obstacles as work location, variable working hours and time zone constraints. VIPS features:

- Voice message store and forward;
- Stand-alone or Office Automation Network access;
- Monitoring of incoming and outgoing messages;
- Personalized broadcast and response service.

Pilot installation of this system will begin this Spring.

Finally, our primary vendor arrangement with Sperry has proved beneficial even beyond their significant gift. The approach to network automation at UAH affords the luxury of simplifying the typically more complex issues of network integration in a multivendor environment. It has further simplified issues related to software and communications protocol standards. Having recently spent several years attempting to resolve such issues at another university, the savings and enhanced progress resulting from this choice are most appreciated.

EVALUATION. Although the project is only in the first of three years, it has been heavily front-end loaded. Of the $12 million total commitment, approximately $5.5 million has been operationalized. Among the benchmarks reached this first year are:

- 250 PC's installed;
- 27 office automation systems installed;
- 50% of the mainframe upgrade installed, (doubling capacity);
- The placement of PC labs in four schools, Continuing Education and the University Center;
- The integration of the PC labs into the curricula of four schools and Continuing Education;
- Two MAPPER applications in development;
- Several LANs being installed;
- VIPS to be installed.

Planning is also underway for additional PC labs, office automation systems, the distributed processors, and the language processors.

The students, faculty and staff are generally quite excited about the project. The students in particular have been most forthcoming in their support for the project. It is a reasonable expectation that this attitude will translate into increased admissions among their recent high school peers.

The single notable disadvantage of the timing of events is that UAH had not reached a decision on an owned PABX vs. AT&T and other vendor options. While this decision will probably be made within six months, it would have been more efficient and convenient to have faced some of our network decisions with that bridge already crossed. As network choices were made, substantial attention was paid to maintaining flexibility for future choices and minimizing unnecessary capital investment.

A pleasant, but not unexpected, development has been a commitment by the Huntsville community of approximately $1.5 million in support of Project ACCESS and other university programs directed at strengthening the technological competence of our graduates and our research program.

While much remains to be done in terms of further integration into the curriculum and networking of the overall environment, the effect of Project ACCESS has been a noticeable enhancement of the institutional image among our faculty, staff, students and the community. Increased "technological comfort" and productivity are widespread among the faculty and staff. Many who doubted their ability to harness the technology have become quite confident in their use of a "new tool".

Evidence is developing to support our strong belief that our students are becoming more adept at and comfortable with the transition into the job market. There is no question that industry and government believe we have added a much-needed facet of the learning experience to our curriculum. Both our students and their current and future employers are the immediate benefactors of the commitment made by The University of Alabama in Huntsville.

BIBLIOGRAPHY

Chakraborty, Samir. "Strategic Planning for Telecommunications--A Systems Approach." Long Range Planning, Vol. 14, No. 5, p. 46-55.

Diebold, John. "Information Resource Management--The New Challenge." Infosystems, June, 1979, p. 50-53.

Getz, C. W. "Coalescence: The Inevitable Fate of Data Processing." MIS Quarterly, June, 1977, p. 21-30.

Kriebel, Charles H. and Strong, Diane M. "A Survey of the MIS and Telecommunications Activities of Major Business Firms." MIS Quarterly, September, 1984, p. 171-177.

Miller, William B. "Developing a Long-range EDP Plan." Journal of Systems Management, July, 1979, p. 36-39.

Townsend, Peter C. "...and there was data base." Infosystems, September, 1980, p. 74, 76.

Wright, Tana Neff and Thompson, Kenneth W. "Strategic Planning for the Design and Implementation of Data Communications." Working Paper, Unpublished manuscript, University of West Florida, Department of System Science, 1984.

Zak, Michael J. "Charting the Waters." Computerworld on Communications, March 14, 1984, p. 51-54.

MIS SUPPORTS STRATEGIC PLANNING

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It is not possible to engage in an effective strategic planning process without the support of management information. An important aspect of the strategic planning process is the effective transformation and movements of information which encompasses three informative systems: data processing system, management information system, and decision support system. Strategic information management should be incorporated in the planning process by looking at the potential impact of information technology on the organization engaged in the planning process. Using good management information with managers who know how to apply the information to decision-making, the strategic planning process is enhanced dramatically.

MIS SUPPORTS STRATEGIC PLANNING

Good Afternoon.

My topic for this program is "MIS Supports Strategic Planning.

In demonstrating this support, I plan to cover five items:

1. What is Strategic Planning
2. Effective Transformation and Movement of Information
3. Strategic Information Management (Example)
4. Two Useful Information Technology Tools
5. Using MIS and DSS in Strategic Planning

WHAT IS STRATEGIC PLANNING

In explaining strategic planning, let's start with a good definition of what it is:

"Strategic planning is that top level, long-range, integrated planning activity which focuses on what the organization should be in the future regardless of current trends or projections."

This definition astonishes some people because of the last phrase, which I will repeat -- "regardless of current trends or projections."

Some organizations have suffered serious setbacks or have been ruined because they made critical decisions based entirely on current trends or projections. Trends are nothing more than the identification of situations as they exist at a given point in time. But situations and circumstances can change. Through directive management, a trend can be changed. Thus, current trends do not have to dictate the future, although they do influence the future. The same is true for projections -- we need not be governed by linear projections of the future from past events.

Winners in any arena, are not projecting their fateful future based only on past events. Certainly we are interested in current trends and projections, because these help us see where we might be in the future if we repeat what we have done in the past. But change must be accounted for in strategic planning, whether it be directed or caused by environmental factors.

So you can see the importance in the strategic planning definition of focusing on what the organization should be regardless of current trends or projections, and then make plans to accomplish what should be done.

Let's assume that most of you can accept this premise for the time being, but you ask, "Why is Strategic Planning itself considered so important?" A simplified response is, "When you fail to plan, you plan to fail."

But why? Well, there are several reasons:

1. The impact of our environment, both external and internal to the organization, has become increasingly important and needs to be studied in more scientific ways.
2. Change is taking place at a more rapid pace than ever before, which means that dealing with possible future events is more complicated and needs to be approached in a more systematic and scientific manner.
3. The need for selectivity, whereby we identify the factors that are the most critical to the success of our organization, has become essential in well managed organizations.

The strategic planning development process is composed of ten steps, as follows:

1. Mission Statement
2. Statements of Objectives
3. Environmental Scanning and Analysis
4. Identification of Strategic Issues and Critical Success Factors
5. Establishing Goals
6. Formulating Alternative Strategies
7. Identifying Preferred Strategies (Strategic Direction)
8. Preparing Action Plans
9. Establishing Priorities
10. Resource Allocations

Because strategic planning involves both the top-down and bottom-up approach to planning, all managers who are engaged in planning and operations have varying needs for information; hence, the need for useful and reliable information. More about this later.

EFFECTIVE TRANSFORMATION AND MOVEMENTS OF INFORMATION

One of the keys to successful strategic planning is the ability of an organization to transform data and information and move it to a state of usefulness for those involved in the planning process.

In other words, an organization must not only be able to acquire relevant data and information, but also be able to transform the information to meet the needs of key decision-makers. The responsibility of information movement and transformation throughout an organization belongs to the operating unit handling the interface for the systems.

Members of an organization should understand the interrelationship and interfaces between the following three informative systems:

1. Data Processing System
2. Management Information System
3. Decision Support System

Confusion often exists because managers fail to understand the critical relationship between decision requirements at different levels in an organization and the capabilities of the three informative systems.

But effective information transformation cannot be accomplished unless the characteristics of these three systems are understood. First, each has a different focus. If information within an organization is viewed on a continuum, we find raw data at one end and decision at the other end.

EDP takes raw data and transforms it into a form which reflects transactional relationships. MIS involves the creation of information and places data in a form useful to a variety of people in an organization. DSS involves the transformation of data into a form that relates directly to specific decisions.

The objective of EDP and MIS are both predetermined. The EDP objectives are based on the type of individual transactions that are to be processed (predetermined). The MIS objectives are based on particular organizational needs (predetermined). In contrast, the DSS objective is based upon the needs of the decision-maker at a particular time which could be predetermined, but most likely will be ad hoc or contingent on some other factor.

Another characteristic of the three systems which needs to be known is the structure of these systems. The EDP system is designed from a technical perspective with emphasis on optimizing the performance of the computer hardware, rigid procedures, and the processing of data for special purpose applications.

MIS has its focus on providing management with information from an organizational perspective. The system involves multiple points of access and service structured procedures.

DSS emphasizes the software aspects of the system and focuses on having a rapport with the users of the system. The operation of the system ranges from semi-structural to structural because the individual decision-maker must initiate and control the system.

The final characteristic is the output of the systems. To most decision-makers, the differences in this characteristic are the most notable and lie in the flexibility or usefulness of the output in coping with on-line situations.

The output of the EDP systems consists mainly of declarative reporting and summary reports and serves as a register of what occurred in a special application. The output of MIS is composed of standardized and interrogative reports which produce forecasts, etc.

In contrast, the DSS output is produced in the form of iterative-interactive and unstructured reports. The end-user determines the reports to be generated. In search of the right type of information for specific decision situations, the user may make many iteratives of particular reports while simultaneously deleting or adding selected variables which are deemed important components of the decision-making process.

STRATEGIC INFORMATION MANAGEMENT (Example)

Successful organizations are always in search of ways to achieve a competitive advantage. Effective use of information technology is one way to do this.

Assessing the current and potential impact of information technology on an organization should be done at three levels -- (1) the education industry as a whole, (2) the organization as a unit within the industry, and (3) the department as units within an organization.

Now, let's take a look at these three levels of potential impact of information technology on an organization from a planning perspective.

1. Industry As a Whole Impact:
   The education industry is mammoth when considering elementary, secondary, and postsecondary education in both the private and public sectors.

This year, it is estimated that $240 billion will be spent on education or 6.7% of the GNP. New electronic processes in the form of information technology are being used in libraries, classrooms, administrative offices, and physical plant operations of our educational institutions. The crucial question for planning purposes is, "What impact will information technology have on our education industry over the next 5 to 10 years in terms of educational services, market attractiveness, and production and operations economies?

2. Impact at Institutional Level:

The education industry has five major forces which impact on the degree of competition at the institution level:

a. Suppliers of knowledge - faculty
b. Consumer of services - students
c. Potential institutions (entry and exit)
d. Substitute services - corporate education program
e. Degree of rivalry among existing institutions

Let us look at each of these competitive forces briefly:

a. Suppliers of Knowledge: Are the faculty conversant in the area of information technology? Is information technology being used effectively and efficiently in the classrooms and laboratories? Are faculty refusing to recognize potential uses of information technology in the institution?

b. Consumer Services: New courses (and programs) and new distribution channels for courses (off-campus, evening, etc.) will be available at some institutions. Information technology can have a favorable influence on consumer services (buyer power) by making it costly for a consumer to change institutions (switching costs). For example, tuition can be slightly lower for each year that students spend working on their degree. In fact, a partial refund could be provided for those who spend all four years and graduate. In this way, they are discouraged from switching to a competitor.

Through information technology, on-line course entry terminals can be provided and educational costs can be determined to show the financial benefits of students staying at one institution.

c. Potential Institutions: The amount of information technology change affects in part the rate of new entry of colleges by acting as a barrier to new entrants in terms of cost and expertise. Major information technology breakthroughs, on the other hand, may act to encourage new entry by colleges not interested in conventional delivery systems or more interested in unique distribution channels.

d. Substitute Services: This refers to educational programs and services that can be substituted for those with higher prices or low performance. We need to know to what extent corporations are providing their own educational services as a substitute for our institution's services.

In addition, information technology substitutes can often be used to help improve productivity in educational programs and services which in turn may reduce prices and/or increase performance.

e. Rivalry Among Existing Institutions: Rivalry can vary from "guerrilla warfare" to a relaxed country clerk approach. Extreme rivalry can damage the education industry.

For an institution to cope strategically with the competitive force of rivalry, management must determine when it is appropriate to compete, when to cooperate, and how to do so effectively.

There are many opportunities for the smaller rival institution to share information systems, software, and computer to computer connections.

3. Strategy for Departments within an Organization: The third and final level for assessing the current and potential impact of information technology is the department within an organization.

Three of the more commonly used strategies used in this assessment are:

a. Can we obtain cost leaaderships position either statewide or nationally?
b. Can our educational services be differentiated on a statewide or national basis?
c. Should we concentrate on a particular market or service niche?

Information technology can be used in the research lab, in market analysis, office record keeping, and other functional areas in an institution to gain a competitive advantage. In fact, more and more institutions are learning that greater strategic benefits are derived when technology applications are supportive of an institution's competitive strategy.

> For example, when pursuing a cost leadership position strategy, an institution may be able to use information systems to reduce costs in the registrar, student personnel, institutional studies, physical plant and business office operations.

If a differentiation strategy is used, the institution may choose programs to be of uniquely high quality through high responsiveness to student needs and the use of information technology.

By first understanding when, where, and how information technology may impact an institution, strategies can be developed which take advantage of information technology as a competitive weapon.

TWO USEFUL INFORMATION TECHNOLOGY TOOLS

In exploring the future for an organization, there are two useful information technology tools which should be mentioned:

1. Cross-Impact Modeling
2. INTERAX

A cross-impact model uses information about future events and their interactions to construct alternative scenarios. Here is a matrix that illustrates the logic of the cross-impact method through an analysis of the interactive effects of several events that have previously been identified in the environmental analysis of strategic planning. The probabilities for each event are the median estimates made by members of a planning committee.

The matrix in the cross-impact model, which is typically simulated on a computer, reads as follows:

It is forecast that there is a 25% probability that federal funding will be substantially reduced by year 2004 (event 1). If that should occur, the changes of event 2 occurring, a repeat of the 1930 type Depression, would be none; the chances of event 3 occurring, a foreign student quota being established, would be increased by 10 percent, and so on.

The purpose of the analysis is not prediction, but to explain how different alternatives might come about. For example, a repeat of the 1930 type Depression as an event, has a substantial impact on all of the other four events; whereas the foreign student quota event has only a minor impact on the other four events. Hence, one would want to track the more significant events to detect early warning signs of changes taking place.

INTERAX, developed by Selwyn Enzer, represents the state-of-the-art in "what if" simulation. This model is based on the following equation:

Future (F) = Projections of ongoing conditions (P)
+ Resolution of Uncertainty (U)
+ Exercise of Human Choice (C)

INTERAX is represented by a spread sheet model that contains projections of key social and economic indicators (P); and a cross-impact model that allows for probabilistic occurrence of technological breakthroughs, discoveries, accidents and natural phenomena (U). When these two models are linked, they simulate a single plausible scenario of the future. Teams of analysts or decision-makers (C) make reviews at annual intervals and strategic plans are established. INTERAX does not predict the future. It generates a different scenario based on probabilities of events, their cross-impacts, and the responses of the analysts or decision-makers.

USING MIS AND DSS IN STRATEGIC PLANNING

In closing, I want to return to the matter of how essential it is to have sufficient and reliable information for strategic planning and decision-making purposes.

Because strategic planning is such a comprehensive and complex process, let me use one small part of the process as an example to demonstrate the dependency on good information.

The environmental scanning and analysis step in the planning process has two components and six categories under each component. First is the external environment and these six categories:

1. Economic, Social and Political Trends and Changes
2. Outside Constituents Influence
3. Education Industry As a Whole

4. Competition
5. Students as Consumers
6. Academic Programs in Relation to Other Institutions

Second is the internal environment and seven subgroupings:

1. Marketing
2. Academic Services (Teaching, Research and Service)
3. Human Resources
4. Financial Resources
5. Support Services
6. Physical Facilities
7. Organization Structure

From this listing, I will use the education industry as a whole as an example of the kind of information that is needed in strategic planning. We need to know:

1. Who are the industry leaders (state and nationally)?
2. How does our educational profile compare with the industry as a whole?
3. How do our financial results compare with industry as a whole?
4. How do our costs and prices compare with industry as a whole?
5. Who are the educational pacesetters?
6. What technological improvements are taking place in the industry?
7. What are the government pressures in the industry?

In gathering information on the education industry as a whole, we want to look at changes, trends and comparisons. From this information and analysis, we identify strategic issues and then develop goals, strategies and action plans which become a part of the strategic plan document.

This concludes my presentation. I will be pleased to answer any questions you might have.

Note: The section on Effective Transformation and Movements of Information was excerpted with permission from an article written by Louis E. Raho and James A. Belohav, "Successful Planning in the Management Information Maze," Managerial Planning, May/June, 1984.

THE COMPUTER RESOURCE
WHERE DO THE $$$$ GO?

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Finances may not be as the bottom line implies. Vital budget lines may be underfunded, others may be overflowing, with no path in between. Nothing can be more distressing than assuming your University's top computer position in the midst of a budget year and trying to figure out what goes where. What are the areas for which Computer Services must budget, how can the usage of these funds be maximized?

The Computer Resource
Where can the $$$ go?

In one sense, it makes little difference as to whether we use two, three, four or five percent of our University's gross operating budget as our guideline for a "reasonable" computer services budget. To each of our competitors for available University funds, it is one heck of a lot of money. Money that we'd best use effectively if we expect to do as well next year. We soon learn that if our "share" is not above the three percent figure that the University won't be competitive for students and/or faculty members.

For well over a hundred years, Villanova University has been under the direction of the Order of St. Augustine, better known at the "Augustinian Fathers", one of the oldest religious teaching orders of the Catholic Church. It has a current enrollment of just under twelve thousand students (FTE) and an operating budget of approximately seventy-five million dollars. 3.8 percent of which finds its way into my hands. As is typical, additional University funds, as well as grants, support the specialized computing needs of the library, a portion of various pieces of hardware/software that the academic disciplines use in their laboratories and offices, and a variety of other University needs. Villanova administrators must work conscientiously to effectively utilize limited University funds.

Just what is the computer resource that I have alluded to?

Hardware
Personnel
Software
Supplies
Time

That list seems to the point, each term applies, but yet there is so much to consider that might be overlooked if we stuck to that list, being abbreviated as it is.

Or should we say

Capital Expenses
Operating Expenses
Developmental Expenses

and mix the previous breakdown in.

Our five year plan (more than likely the three year one is more realistic as we recognize the volatility of our field) should provide guidance when one considers Capital Improvements.

Capital Expenses

Facilities Improvements
Furnishings
Hardware
Software

Planning, planning, and more planning are necessary to define these needs. Quite often the mainframe vendor is delighted to provide (at no cost to us), the talents necessary to "design" the facilities that increased utilization necessitates and to anticipate needs for power, AC, humidity control, hardware placement, security measures, etc. Creature comforts will play a major roll in the retention of talented personnel - the cost of outfitting a number of offices with carefully selected furniture and equipment can be covered by the cost of recruiting but one senior person through a "body shop" (or should I be polite and say an employment agency).

Many of the budget items that I shall now discuss under Operating Expenses are equally at home under Capital Expenses and Developmental Expenses as well. Typically when the dollar values are low, I tend to sneak them into Operating Expenses where they are less apt to get cut out. What I am attempting to do in this paper is to identify the myriad of areas for which we may be required to budget. In some cases, I shall comment on potential areas for savings.

The following list is in alphabetic order (really for no special reason).

Operating Expenses

Computer Supplies
Contractual Services/Purchases
Office
Staff Personnel
Telecommunications

This list too is very generalized, but not for long.

Computer Supplies

Cables/Connectors/Wire/etc.
Disks/Diskettes/etc.
Forms/Paper/Cards/etc.
Ribbons/Tapes/etc.

At both Fordham and Villanova, we have found it beneficial to purchase our cables, connectors and the like in large quantities and to fabricate the cables needed ourselves, saving both dollars and time. The actual cost of removeable disk packs drops drastically when competition is set up between the mainframe vendor, the companies that clean the disk packs, and computer supply vendors. Buying large quantities of diskettes and having them made available to all users by Central Stores cuts down the unit cost considerably. For the longest time at Fordham, it seemed that Computer

Services was the only one to worry about the spiraling costs of paper and paper products. There was no forms control. Users would schedule normal runs instead of test runs, thus using the special forms instead of one-part white paper, make modifications to their data and then make another run. By the time the final run was scheduled, the forms were used up. One becomes hesitant in ordering large quantities of any form that is rarely used and is apt to be modified between usages. Putting the dollars for forms and forms management into the hands of the specific user not only greatly reduced costs, but improved user/computer center relationships. As before, all forms were delivered to the Computer Center's store room, but are now inventoried by the user before being stored and at the same time removing obsolete forms with similar identification numbers. Say, version XX.7 when XX.8 is the current one. As with diskettes, all ribbons and other printer supplies were ordered in quantities recommended by Computer Services as was one part white paper for users and made available through Central Stores for individual budget managers.

Again in alphabetical order for the areas in which we are apt to contract for services and to purchase or lease hardware and/or software.

Contractual Services/Purchases

- Disk Cleaning
- Facilities Improvement
- Facilities Management
  - Salaries
  - Overhead
  - Reimburseables
- Furnishings
- Hardware Acquisition
  - Mainframe Upgrade
  - Micros
  - Peripherals
  - Word Processing
- Hardware Leasing/Rental
- Hardware Maintenance
- Micro Leasing
- Micro Maintenance
- Microfiche Processing
- Software Acquisition
  - Mainframe Upgrade
  - Micros
  - Performance Monitoring and Evaluation
  - Peripherals
  - Word Processing
- Tape Cleaning
- Terminal Leasing
- Terminal Maintenance
- Under Floor Cleaning
- Word Processing
  - Leasing
  - Maintenance

My gosh, what a list! Where did they all come from? In all cases we must carefully watch the vendors costs, the cost of money to the University, the value of the same money to the University, and the life of each specific package of hardware/software to the University. In many cases the vendor will guarantee to freeze the monthly cost for a two year period and grant a 12% discount should it be otherwise to our benefit to sign a two year contract. Can we afford not to look ahead that far to make a decision?

Whereas I have not found great competition in the disk cleaning business, the benefits of cleaning, testing for bad areas on the recording surfaces, and the extremely generous trade in's and sale prices of new disk packs provide excellent benefits to computer services.

Facilities improvements tend to be one tough customer; be it the enlarging of or increasing the number of specific offices or machine rooms, the adding of a conference or storage space, or simply the titivation of current facilities. Likewise additional terminal lines to the communications switch, enhanced power or air conditioning services, or occasionally the use of University maintenance personnel to build new shelves or the like are items that funding must be provided for or productivity diminishes.

Facilities Management, the title of the paper I delivered at the 1979 EDUCOM Fall Conference and later published in "Planning for Computing in Higher Education", EDUCOM Series in Computing and Telecommunications in Higher Education #5, 1980, is an interesting and potentially expensive area. Like all other things, it is not for everyone. It is a very personal decision on the part of each college/university and for them it may be a very cost effective solution.

When we consider office furnishings, the concept of ergonomics (or should we use biotechnology) rears its head. Sitting on an uncomfortable chair, with the scope at a less than desirable height, and with a slight glare can destroy productivity. In the long run the higher cost may well be the cheapest way to go. One cannot always attach a dollar value on the loss of a productive, talented staff member. The intangible costs are there. I always think of the TV ad pushing the periodical change of engine oil and filters on our cars. It basically states that if you don't make the minor expenditures now, you'll get hit with a big one later (car or engine replacement). We don't need to be told that comparative TLC for our staff has the same benefits.

Hardware acquisition provides endless opportunities for savings. It is not true that we have to go to the mainframe vendor to acquire brand new hardware to be shipped directly from the vendor. As an example, there were turnkey systems vendors in Westchester County, New York that purchased packaged hardware systems in large quantities from DEC. Systems that they preferred to use CDC disk drives on, and they sell the provided RP06 or RP07 disk drives at 50 - 75% of list, delivered to your door and installed by DEC and fully eligible for DEC maintenance. Make a few such purchases and watch your sales representative start to match prices. Then too, as an example, do we really need that DEC VT100 terminal at some 1100.00 plus dollars or will the plug-to-plug compatible ZENITH Z-29 do the job for us at 60% of the cost (and surprisingly at a slightly lower monthly maintenance cost.) We not only found that Ampex MOS add-on memory would not only do the job that the DEC MOS core would do, but at half the price and interestingly enough DEC maintenance was willing to pick up the maintenance on it at the same price that Ampex charged (which was lower than DEC's normal charge). Interesting too is the fact that STC sells Documentation printers for use with DEC systems and DEC will perform the maintenance on these too. Thus our old worry about finger pointing between vendors is greatly minimized. Nor should we loose sight of the fact that the vast majority of the equipment we might want can be picked up, used at a far lower cost and yet will qualify for mainframe vendor maintenance. It's not like buying a used car. We can ask ourselves some of the same questions and see the same type of results when we talk about micros, word processing systems, etc. Do we really need the IBM portable PC or will the, as an example, Panasonic Sr. Partner be a more cost effective solution? When we think of the IBM Displaywriter (now obsolete) or the IBM PC with DisplayWrite2, an interesting comparison can be made with the Syntrex Aquarius. You'd be surprised at which communicates best to the IBM mainframes. Should our college/university be a member of EDUCOM, then top-notch discounts can be had thru their group buying plans. Look them over. Many married people feel that when their spouses stop looking they are dead. When we stop looking at alternatives in the acquisition of hardware, we too are dead.

There are times when the big boss just can't come up with the funds to allow for the purchase of new hardware and one is forced to look at a lease or lease-to-purchase arrangement. How wrong I was, certainly CLE, Bankers Leasing, or one of the many third party companies would come across with the most cost effective proposals. But no, old IBM's proposal on a lease to purchase came in lowest both on the monthly basis and on the balloon note for purchase at the end of the contract for an upgrade from the IBM 4341-II to the 4381-I this past September. Simply stated, don't overlook any alternative source of funding; what may have been the case last year may not be true this year.

Though I have not yet taken advantage of third party maintenance for the entire hardware system, the very presence of Boeing Computer Services Company in the New York area had a dampening effect on the attitude of DEC maintenance for the same area. Unfortunately for us at Fordham, Boeing specialized in DEC VAX 11/700 series systems and not the DEC System 2060's. Boeing's rates were considerably lower, their store of spare parts was at a comparative level to those maintained by DEC maintenance, and their user satisfaction as great or greater. Under such conditions, it becomes quite hard not to justify the taking advantage of a 10-20% decrease in maintenance costs. Then too, the GANDALF Switch and the Ampex add-on memory were so reliable that an alternative method of maintenance proved cost beneficial. The acquisition of a few replacement boards, the testing of the system by staff personnel, the replacement of defective boards with one of the replacements, and the returning of the board to the vendor for repair by UPS are the steps we must follow. They didn't really give us each board we'd sent in, just replaced them with remanufactured boards by return UPS and sent our boards to be remanufactured and ultimately to some other user. The first year costs are about the same as before, having to buy spares; thereafter there is a considerable savings.

Sometimes, to our chagrin, grants explicitly specify that hardware, in many cases a micro or a terminal, cannot be purchased through the use of grant funds, but that hardware can be leased. Such hardware requirements must be looked at closely. Would we desire utilization of the hardware upon termination of the grant and are we willing to pick up maintenance costs thereafter as well? If so, best the University became the third party; lease or purchase the hardware from the most cost effective source, and lease it to the grant. With a typical three year grant, the hardware can be yours before the grant has concluded.

Depending on the vendor, maintenance on micros can be a joy or a disaster. For some there are service outlets that we can bring or mail the micros to. For others like DEC, they will maintain on site. The availability of affordable maintenance thus becomes a critical factor in the selection process. At Fordham we had one professor who was very willing to spend University funds as follows - a maintenance contract on each of 20 Commodore 64's at $175.00 each per year. True, they would come to you to repair same. But new units could be purchased for approximately $200.00, failure rate was very low, and they could be repaired locally, if brought in, for $175.00 per micro. Whose money it is become an interesting factor.

For all of us, software acquisition, as hardware acquisition becomes a case of carefully checking all services. It becomes financially frustrating when DEC, for instance, starts selling what was formally third party software. The cost goes up, the quality goes down. Even with an education discount the prices mainframe vendors charge for comparative items force one to a third party vendor. On the DECSystem 2060, their Basic Plus costs many times more than the third party MAXBASIC. It is hard to cost justify the differences.

The term third party pops up again and again in our financial dealings. At Villanova we have found it to our advantage to have all terminals maintained by one vendor who keeps one man and all spare parts on site. Our costs have reduced and responsiveness has increased drastically. Having both DEC VAX's and an IBM 4381-1 greatly increases the variety of terminals we have.

As we have seen, the areas for which we must budget for contractual services is vast and I'm sure that you can readily add three or four more.

Office

Copying Charges
Graphic Services
Mail Service
Office Equipment Maintenance
Printing
Supplies/Materials
UPS

This group more or less speaks for itself, the importance being that each one needs to be considered as we plan our budget annually.

Personnel

- Contractual Services
  - Data Entry
  - Temporary Employees
- Miscellaneous
  - Dinner Funds For Overtime Workers
- Recruitment
  - Advertising
  - Recruiting Funds
  - Travel Funds
- Relocation
  - Employee
  - Family
  - Household Effects
- Salaries/Wages
  - Admin/Professionals
  - Consultants
  - Fringes
  - Sec/Cler/Tech OT
  - Sec/Cler/Tech PT
  - Sec/Cler/Tech Wages
  - Students-General-AY
  - Students-General-Summer
  - Students-General-AY
  - Students-Work Study-Summer
- Support
  - Documentation
  - Dues and Memberships
  - Miscellaneous
  - Periodicals
  - Publications
  - Professional Conferences
  - Professional Development
  - Training
  - Travel

Personally I consider Personnel the most important of our budget areas, the one most difficult to contain at a reasonable level. We hunt for those capable of quality performance; yes, quantity performance tinged with timeliness. A well trained person, trained by ourselves is far and away the best dollar buy for his/her current position and quite often for the position one step ahead. Why then are we sometimes so negligent as to let the incumbent slip out of our hands. I agree that there are often times when there is nothing reasonable that we can do to retain talent - but so often we lose staff members when being reasonable would have retained them. Just what do I mean - a competitive salary/benefits package for the geographical region, a challenging group of assignments with a fair mixture of design and maintenance, and the opportunity to retain currency by the attendance at specific courses/ conferences. Advertising in the New York Times as we had to at Fordham, is no bargain. A small Sunday advertisement about an inch and a half by one column with two font styles can hit $500.00. But they are effective. Colleagues of mine in New York felt this not to be the case and heavily relied upon recruiting agencies - at 15% of a $15,000.00 salary and

20% of a $20,000.00 salary, etc. In spite of being able to negotiate at the higher salary levels, this is one heck of a charge. Out of state applicants worried me if I did not see that the applicant had been brought up in New York, or had gone to school there. The cultural shock of New York is devasting. One really has to want to be in New York or he/she will leave before long. Needless to say, I made a point of having applicants ride the subway, walk around in the downtown area at noon, check the rental costs of houses/apartments, note the cost of auto insurance, and last but not least, get an idea of the bind NYC and NYS taxes would put on them. It's cheaper to loose the person before he/she starts working than after. As many are entranced with the small town approach, many too love the excitement of the big city. To me it is important that the applicant know what is in store for them.

Professional development need not be the big expense item that it appears to be. While it may not be as much fun, hiring the training company to put the course on at our site can greatly reduce unit cost and thus allow us to maximize the effectiveness of our professional development dollars. A major advantage of this is that an employee whose performance may not justify being sent away to a course under a limited amount of travel dollars may now be able to attend.

Telecommunications

Hardware
Installation
Maintenance
Monthly Charges
Software
Toll Calls

Unlike many universities, the responsibilities of UCIS at Villanova includes voice communications (telephone) as well as data communications. The amount of data that the voice system collects is mind boggling (and most of it is useful). One finds that an in-depth knowledge of and understanding of the tariff structures can save considerable funds.

Many organizations have run into funding problems with their new system developmental expenses, not so much as underestimation of certain costs, but rather a failure to consider all possible needs.

Developmental Expenses
(Normally Underestimated Source of
Additional Costs)

Development Costs
Operational Costs

As can be seen, I have broken these expenses into two groups. Certainly many of the latter are simply add-ons to our current expenses, the costs of such are often sufficiently higher as to warrant specific additional funds, rather than attempt to cover with normal funding.

Development Costs

- Database Generation
- Database Study
- Data Capture
- Data Conversion
- Data Entry
- Design
- Documentation
- Facilities Preparation
- Feasibility Study
- Hardware Expenses
- Office Facilities
  - Bookcase
  - Chair(s)
  - Desk
  - Filing Cabinet
  - Table
  - Phone
  - Office Space
  - Office Supplies
  - Terminal
  - (one set each per person)
- One-Time Training
- Personal (DP and USER)
- Program Conversion
- Program Creation
- Program Expenses
- Software Expenses
- Testing
- User Participant Salaries
- Vendor Training (Training of the Vendor)

Certainly all of these items may not apply to your specific implementations , but then again they might. The larger the system to be worked upon, the greater the need for additional outfitted office facilities. Each additional person be he/she a new hire, or user participant, or a software house staff member will require an adequate working space, properly outfitted. We could well find ourselves requiring additional ports on the system to handle the computer intense activities of our new staff members.

We often overlook the vast amount of our time required to educate each potential vendor of our specific needs, of our way of doing things, of the idiosynchrosies of our system, etc.

It can eat up an awful lot of time. Should we be planning or installing a new student support system (Admissions - Registrar - Financial Aid - Bursar - etc), we certainly require the presence of a top level staff member from for example, the Registrar's office. Who in the Registrar's office can immediately be available for 50-75% of their time? Don't tell me, for sure it is not the Registrar or any of his top assistants. I thus budget funds so that a temporary replacement can be brought into the Registrar's office and make top level experience available for participation on our team. From an accountability point of view, the costs of our regular staff assigned to the project should be charged against the project so that the real costs can be determined. An interesting question, who budgets for the entry of user data into the new system to bring needed files up to date? Certainly the user doesn't have the staff available.

Operational Costs

- Air Conditioning, etc.
- Backup
- Communication Expenses
- Computer Time
- Data Maintenance
- DP Personnel
- Documentation
- Electrical, etc.
- Hardware Maintenance
- Paper/Cards/etc.
- Recovery
- Recurring Training
- Software Maintenance
- User Personnel

Hopefully, we have anticipated these additional costs, but here they are. We like to make believe that the increased systems utilization forced upon the hardware by the need to run and maintain the old system as we develop the new system will be reduced once parallel testing has been completed. New systems typically include so many additional features that it never works out that way, and many of the expenses we are now considering stay on to haunt us.

Well, we've looked at an endless procession of slides, each listing potential areas for which we must budget. Not only must we state the items, but we must justify them as well. I sincerely hope that this total listing will be of help to you in noting where the dollars have gone.

MANAGEMENT FRAMEWORK FOR COMPUTING AND COMMUNICATIONS

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1.) INTRODUCTION

1.1) ABOUT MOUNT ROYAL COLLEGE

Mount Royal College (MRC) is a 2 year post-secondary institution in Calgary, Alberta. The city's population is about 630,000, and in addition to MRC, there is a University and an Institution of Technology serving a total population base of about 1 million.

At present the College has approximately 4500 FTE students. It is governed by a Board of Governors appointed by the Provincial Government.

To allow for added emphasis on Technology and Community Services there is a $60 million expansion program underway. This should nearly double the student population by 1987-88, and presents major challenges and opportunities.

As most other publicly funded post secondary institutions, MRC has had to face rapidly increasing enrollment, rapid envionmental change and reduced funding. The consequences are well known, and MRC's case is no different. Such an environment places particular importance on the use information technologies and on the services provided by the Department of Information Systems.

1.2) INFORMATION SYSTEMS AT 'MRC'

The Department of Information Systems (IS) is responsible for

. Computing and Data Processing Services
. Telecommunications (data, text, audio, video) Services
. Office Services (including word processing, printing/duplicating, office automation etc.)

IS provides these services, to both the academic and non-academic communities. The Director reports to the VP of Administrative Services, who in turn, reports to the President.

Prior to 1982, the delivery of the above services, and the mode of operation was mostly informal and fragmented. For instance, there was no clear mandate or objectives for the units involved: there was little coordination between the Computing, Communication and Office Services areas; there were few, if any, policies or procedures; no priority setting and resource allocation process; there were no documented standards or target service levels etc.

This paper will show how the historically based problems are being gradually overcome, and how an effective management framework is being put into place. The lessons learned and the experience to date will hopefully assist others facing similar problems.

2.) FIRST STEPS TOWARD A MANAGEMENT FRAMEWORK

Work began early in 1982 on the following two fronts:

2.1) STABILIZATION

To attack immediate operational problems and to gain time for a longer range restructuring, an 'installation audit' was conducted by a reputable consultant, followed by a survey of users and management to identify 'burning issues'.

Based on the findings of the above, a number of steps were taken. These included:

- a start on the construction of a Computer Operations environment that measured up to professional standards
- implementation of a production control, change management and problem management procedures
- initiation of a formal performance monitoring and capacity management programs
- training of all programmers and analysts in the use of Yourdon's methodologies
- implementation of formal project planning and status reporting process
- launching of 'telecommunications support' as a new and independent function
- development of an electronic link between word processors, typesetters and large computers
- and many others

The full support of the College's Executive Management was essential and available during this stabilization period. This experience has shown that, in addition to Executive support, the elements critical to success during a 'rebuilding process' are:

- the physical environment
- staff skills and motivation
- planning, monitoring and adjustment process
- channels of communications with the people being served
- adherence to professional standards
- technological currency

2.2) SENIOR MANAGEMENT PLANNING SESSION

To deal with the lack of direction in the IS-area, the 15 or so senior officers of the College participated in a 2-day intensive planning session. The key objective of the session was to define how information management should support the College's mission, goals and objectives.

Following intensive discussions, the most immediate issues relevant to achieving, both Academic and Administrative/Service objectives were determined to be:

- Definition of overall institutional policies relating to the management of information technologies
- Definition of the decision making process
- Definition of the most suitable organizational structure
- Definition of a planning process for computing/communication/office automation related services
- Definition of procedures/guidelines to govern day-to-day operations

Although the above emerged from intensive roundtable discussions, embedded in these issues are the generally recognized management functions of ORGANIZING, STAFFING, PLANNING, DIRECTING and CONTROLLING. Thus our longer term problems were not unique. To deal with them, a task force, consisting of a consultant, a Dean, and the Director of IS, was asked to develop recommendations for Executive approval.

The following sections describe the results.

3.) OBJECTIVE AND INSTITUTIONAL POLICIES

As a first step, the Executive Committee was asked to approve the following statement of objectives for IS:

'The coordinated, cost-effective, planned introduction and use of information handling, computing and related technologies for the maximum benefit of Mount Royal College'.

The notable features of this statement are:

. Institution-wide mandate
. Coordinated, integrated, uniform approach to all related technologies
. The desire to measure costs and benefits, where possible.

The overall, institutional policies approved at the same time reflect a similar philosophy.
They include statements such as:

1.) Technology will be employed to serve the best interests of the College community at large.
2.) College will employ 'up-to-date' and 'proven' but not 'leading-edge' technologies.
3.) The College will seek the optimum balance between integration, sharing, and central planning on the one hand, and individual initiative, creativity and special purpose applications on the other.
4.) There will be College-wide coordination of the use of information processing technologies and of shared data.

The underlying philosophy of these policies reflects the desire for optimum blending of central control, direction, and accountability with maximum freedom, service and creativity for the individual user.

Such an approach is consistent with the College's general management philosophy and with its approach to the management of other key resources.

4.) ORGANIZATIONAL STRUCTURE

From an organizational perspective, the decision was to combine responsibility for academic and administrative computing/communications services into one unit. As well, all related technologies were collected under the same organizational umbrella. We concluded that the College was simply not large enough to justify the setting up of several independent organizational units. The fact that our emphasis had to be on service to instruction rather than research also suggested the need for one integrated service unit.

These decisions allow for a lot of central control and direction. Every effort was made to balance them with protection for users, individual freedom of action and creativity. Key decisions relating to resource allocation, equipment acquisition, planning etc. are reviewed by a middle management group chaired by a user representative. Groups of users of similar interests meet monthly with IS to outline their priorities. Allocation of resources to the instructional and administrative users is carefully measured and monitored. Standards are prepared by IS, but must be approved by the middle management committee. Furthermore, standards usually consist of a small number of preferred alternatives rather than a single, firm prescription. The introduction and use of microcomputers is coordinated by the Microcomputer Instructional Centre, which is directed by a user manager and a committee of users. Policies permit the distribution of hardware, and assign the responsibility for day-to-day operation to users.

This represents a compromise that has to be the continuously reevaluated in light of institutional and technological changes. To arrive at the present organization, the Executive Committee, the above mentioned task force and, in a sense, the entire College has had to re-live the Centralization vs. Decentralization debate. A digression is in order here to summarize the considerations that were taken into account. *(1)*

4.1) Centralization vs. Decentralization

There are three aspects to the centralization issue:

. CONTROL, or the locus of decision making power
. LOCATION, or the physical siting of facilities
. FUNCTION, or the position of a given responsibility within the organization (e.g. central vs. distributed programming or accounting function).

The debate over centralization/decentralization has been going on in a 'see-saw' fashion for a long time. Some of the common arguments are summarized in FIG 1. It all boils down to a trade-off between **efficiency** and **effectiveness.** The former stands for the organizational advantages of control, uniform quality, economies of scale, while the latter is the symbol for user needs, local productivity, greater initiative etc.

The rapid reduction in hardware costs, the spreading of microcomputers etc. appears to weaken the economic justification for centralization. So why not decentralize, with all the affordable hardware on the market today? There are two main reasons.

- One is that the cost of computing entails more than just the acquisition of hardware. While the entry-cost, i.e. the cost of hardware acquisition is going down, software costs, maintenance costs, communications costs, management costs etc. are going up.

- The second is that decentralization of computing often means decentralization of other critical organizational functions too, due to the increased reliance on computing at all levels. Such a wide ranging decentralization may often be contrary to the wishes of top management, and is almost always irreversible. Thus there could be a basic conflict with the organization's management style.

Whereas the first of the above two (i.e. economic considerations) is usually in the forefront of the debate, it is the second that will often tip the balance. Even though research indicates *(2), (3)* that centralized organizations may be more economical, the essential deciding factor has been CONTROL and MANAGEMENT style.

This leads to the three alternatives summarized in FIG. 2. MRC has opted for the middle-ground. This was done by balancing the centralized IS department with steering committees, formal project justification processes, formal channels for user input, encouragement of user participation, resource allocation policies etc. The final verdict is, of course, not in yet. Continuous reassessment will probably be a fact of life.

Two related aspects of the decisions regarding organizational structure at MRC may be noted.

- One is that the integration of related and mutally interdependent technologies in one organizational unit is mainly technologically motivated. Computing, data and voice communication, office automation, electronic printing etc. are so inter-related technologically that their separation would almost undoubtedly lead to overlaps, duplications, jurisdictional disputes etc.

- The other aspect has to do with the internal organization of IS. Theoretically, the department could be structured on the basis of:

  . Function or process
  . Service or product
  . User or organization being served
  . Region or location
  . Combination of the above.

We have chosen a somewhat ad hoc combination. The function-based division of responsibility dominates, as we recognize groups responsible for systems development, computer operations, telecommunications etc. However, the scarcest of resources, such as computing power or analyst time are also divided on the basis of users supported. This allows us to allocate a variable X% of those resources to academic or instructional users. The target percentage X is set by the steering committee, and actual resource use is reported monthly. This is one of the means of making the central vs. decentral compromise work.

5.) STRUCTURE FOR DECISION MAKING AND COMMUNICATION

Given that the policy and organizational issues are settled, the next component of the managmenet framework to be dealt with is the decision making process. This has to do with authorities, responsibilities, delegation, the flow of information etc., and leads to the classical management triangle consisting of STRATEGIC,TACTICAL and OPERATIONAL levels of management.

'MRC' adopted this classical approach, in principle, but modified it by putting in the 'checks and balances' necessary to yield an optimum mixture of hierarchically based control and local autonomy.

The results are shown in FIG 4, which summarizes the responsibilities at each level, and indicates the nature of information flows. The Organizational Structure is shown on FIG. 3. The key innovation is the Computer Advisory Committee (CAC), whose members appointed by the President, are senior managers (deans, directors etc.) just below the VP level. The chairman of 'CAC' is a user representative, while the secretary is the director of IS. 'CAC' plays a pivotal role. The President and/or the Executive Committee have decided not to make decisions related to computing/communications without first hearing from 'CAC'. The user groups and committees shown on the 'Operational Level' are designed to ensure direct participation by users, and the smooth flow of relevant information to users.

It is possible to infer from the foregoing that line management is by-passed by the committee structure. That does not happen. The usual line management authorities and responsibilities are carefully preserved. However, the responsible individual at any of the levels doesn't act without the advice of the appropriate committees. This is once again a compromise designed to ensure adequate user input, while preserving the managers' accountability.

6.) PROCEDURES AND GUIDELINES GOVERNING THE DAY-TO-DAY OPERATIONS

Given the foregoing organizational structure, management style and fundamental policies, more specific and detailed procedures are still needed to guide everyday operations. These procedures should describe:

. How priorities are set and resources allocated?
. How proposals are to be submitted?
. How requests for acquisitions or services are to be handled?
. How management of resources is to take place at the operational level?
. How data is to be shared and its integrity protected?
. Etc.

Two sets of such procedures will be described next to give some indication of their potential value to the institution.

6.1) PROCEDURE FOR EQUIPMENT ACQUISITION

A matrix of SCOPE OF USE (e.g. individual, departmental, divisional) and of KEY FUNCTIONS (e.g. requirements definition, technical planning etc.) was constructed. Each cell of the matrix contains the identifier of the individual or group responsible for a given function with a specific scope.

Next, a set of forms were developed in order to collect all the relevant information concerning the nature of the requests, the technical and economic factors involved etc. This was important to ensure equitable treatment of all requests.

Finally, to formalize the 'approval-to-purchase' process, a Chart of Approval was developed. This defines the approving authority based on key considerations, such as purchase cost, conformance to standard product lines, scope of use and whether IS supports the request from a technical point of view.

6.2) PROCEDURE FOR HANDLING SYSTEMS PROJECTS

The procedure the College has adopted has the following three elements:

6.2.1) IS resources were divided into 'maintenance,' 'development' and 'other' categories by percentage of manpower available. (Where 'other' stands for resources not involved in systems development). This allocation is reviewed, and adjusted annually.

6.2.2) The maintenance group is further subdivided according to major user type (e.g. Financial Systems). A designated user manager sets priorities for each of these resource groups. IS manages these resources, reports on performance, assures quality etc.

6.3.3) Requests for development type projects are submitted by users in the form of well structured proposals. These are then costed by IS, and ranked by line management within each of the divisions of the College. Project proposals and rankings are then submitted by the divisions to 'CAC', who prepare recommendations for Executive Committee approval. IS assigns and manages the development resources in accordance with the above priorities.

The essence of this procedure is that users justify projects and define priorities, whereas IS is responsible for managing the resources, getting the work done and for safeguarding quality. Adjustments have been made to account for resources devoted to administrative activities, overhead, and for the unavailability of specific skills. The procedure appears to work and earlier high levels of frustration (due to an unstructured process of competition for scarce resources) has been reduced substantially.

There are many other procedures and guidelines that are necessary and have been developed, but cannot be described due to lack of space.

7.) PLANNING PROCESS

To assist with systematic planning, MRC decided to adopt asomewhat modified version of the Information Resource Planning (IRP) technique used by the consulting firm involved. The goal of IRP is to provide an information processing plan that supports the organization's needs and is consistent with the organizations goals and objectives. According to IRP, there are five major planning activities to be performed periodically (most likely annually). These are summarized in Fig. 5.

The first component, Institutional Strategy, has been developed and published. Work is currently underway to complete the Information Management and Information Architecture components. A large part of Systems Architecture has evolved over time, but will have to be reconsidered once the preceeding ones are completed.

To develop the Information Management Strategy, 'CAC', has requested an inventory of existing computer/communications applications, and a listing of planned applications for the next 3 to 5 years from all concerned. The latter will have to be accompanied by a detailed statement of purpose, costs, benefits, risks etc. (as in a normal project proposal). The committee will then consolidate this information, distill a general focus and thrust, and develop an evolutionary strategy to support the objectives expressed. Lastly the document will be subjected to the usual reviews by the College Community. Work on last two components will be done largely by IS, whose proposals will be examined by 'CAC' prior to submission to the Executive Committee.

Results to date are again favorable. The major improvement is that a planning process has been understood and committed to by most. The specifics of the planning process chosen appear to be secondary to the psychological benefit of having one in place that is well understood.

8.) CONCLUSION

The last 2 - 3 years at MRC have certainly not charted unknown territories in the area of managing the provision of technologically based services in a post-secondary institution. A number of important lessons were learned, however, which may help guide other managers embarking on similar journeys. These are summarized below:

8.1) The need to focus on the critical success factors

During the early, stabilization period we had to have a very clear understanding of what essential results were expected, and which key ingredients (e.g. management support, skilled staff, technical standards) were necessary to achieve them.

8.2) Consistency with institutional management style

The framework just described works for MRC because it 'fits', because it is compatible with the institutional atmosphere.

8.3) Issues for upper management

To put an IS-like organization on a sound footing top management should create (or cause to be created) an environment characterized by:

- clear directions, policies,
- well defined decision making process
- effective organizational and communication structure
- well defined planning process
- clear operational procedures and practices

8.4) Centralization vs. Decentralization

The selected approach should be clearly described and should include provisions for review. There should be clear direction on the integration of related technologies, and the internal organization of IS resources.

8.5) Management structure or framework

One respecting the role and authority of line management in a hierarchical structure is still the best. Clear lines of communication and the type/extent of delegation should be described.

8.6) Day-to-day operational procedures

These must be described very clearly and in detail. They must be simple, practical and must be seen to be fair.

8.7) Reviews

A process for continuing assessment and adjustment must be built in.

8.8) Outstanding Issues

At least two key questions remain unanswered and would benefit from further research. These are:

- How to ensure adequate communication, the involvement and commitment of all concerned in a large organization, without introducing inefficiencies?
- How to ensure that the optimum organizational mix (central vs. decentral) is adjusted as required by changing circumstances without causing too much uncertainty and instability?

Some of the issues described in this paper have been at the center of heated debates in many institutions. Even such issues can be dealt, with, given that there is clear direction, effective channels of communication and a clearly understood process for dealing with the issues.

CENTRALIZED

- Economies of scale are possible
- Avoids redundant data, hardware, software etc. costs
- Easier to control and manage. Preserves top managment's prerogative to manage resources
- Avoids incompatibility between systems
- Easier to plan in a coordinated, organization-wide, integrated manner
- Better concentration of skills. Makes specialization more affordable
- Use of professional methods, standards, quality are easier to ensure
- More complex and costly organizational communications
- Reduced appreciation of local user needs. Possible loss of productivity.

DECENTRALIZED

- Gives users more control over operations
- Better able to tailor to each user's needs
- Users better motivated
- Allows for close cooperation with other units and for local initiative
- More productive use of resources
- Loss of possible economies of scale
- Difficult to enforce organizational standards, protocols and cooperation

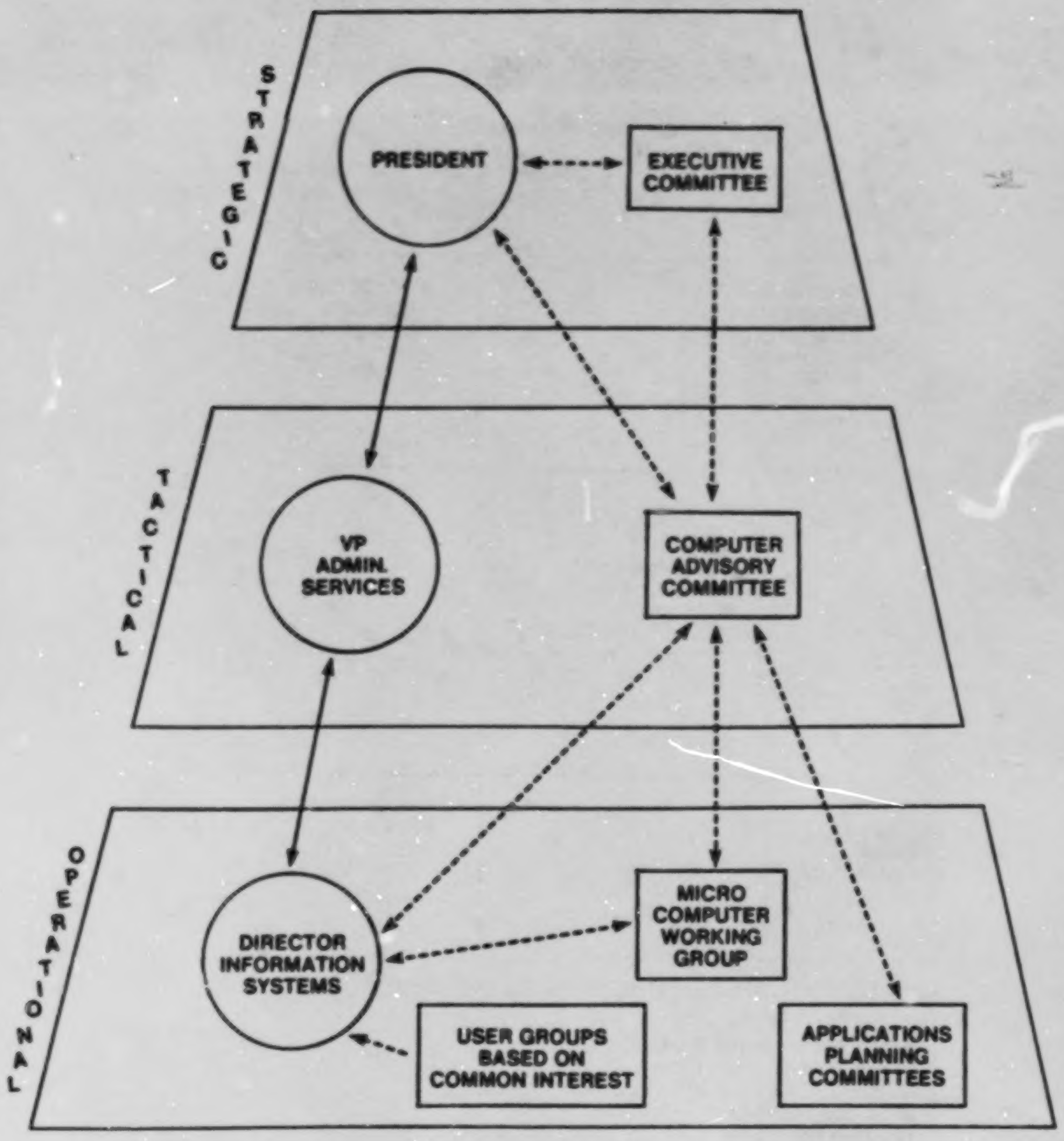
CENTRALIZATIONS VS DECENTRALIZATION

FIG. 1

	CONTROL	LOCATION	FUNCTION
CENTRALIZED	All decisions regarding acquisition, development priority setting etc. consolidated in one place.	One central facility accessed from centrally managed service locations.	All major functions consolidated at the central facility. Users manage only functions directly related to their work (e.g. data entry).
INTER-MEDIATE	Central control retained over acquisitions standards, quality, planning, priority setting etc. Local decision making over equipment, software etc. to be used locally. Approved standards must be followed.	Only large, expensive equipment is consolidated. Users may 'own' smaller units. Central and user facilities may be networked.	Consolidation of large, expensive specialized functions. Users allowed their own capabilities for department-related functions.
DECENTRALIZED	Most decision making is at the local level. Organizational direction/control is exercised only via financial and individual performance reviews.	Users establish own facilities as they prefer. Users rely on central facilities only when unavoidable.	Users have total control over functions, which are then integrated into normal departmental operations.

ORGANIZATIONAL ALTERNATIVES

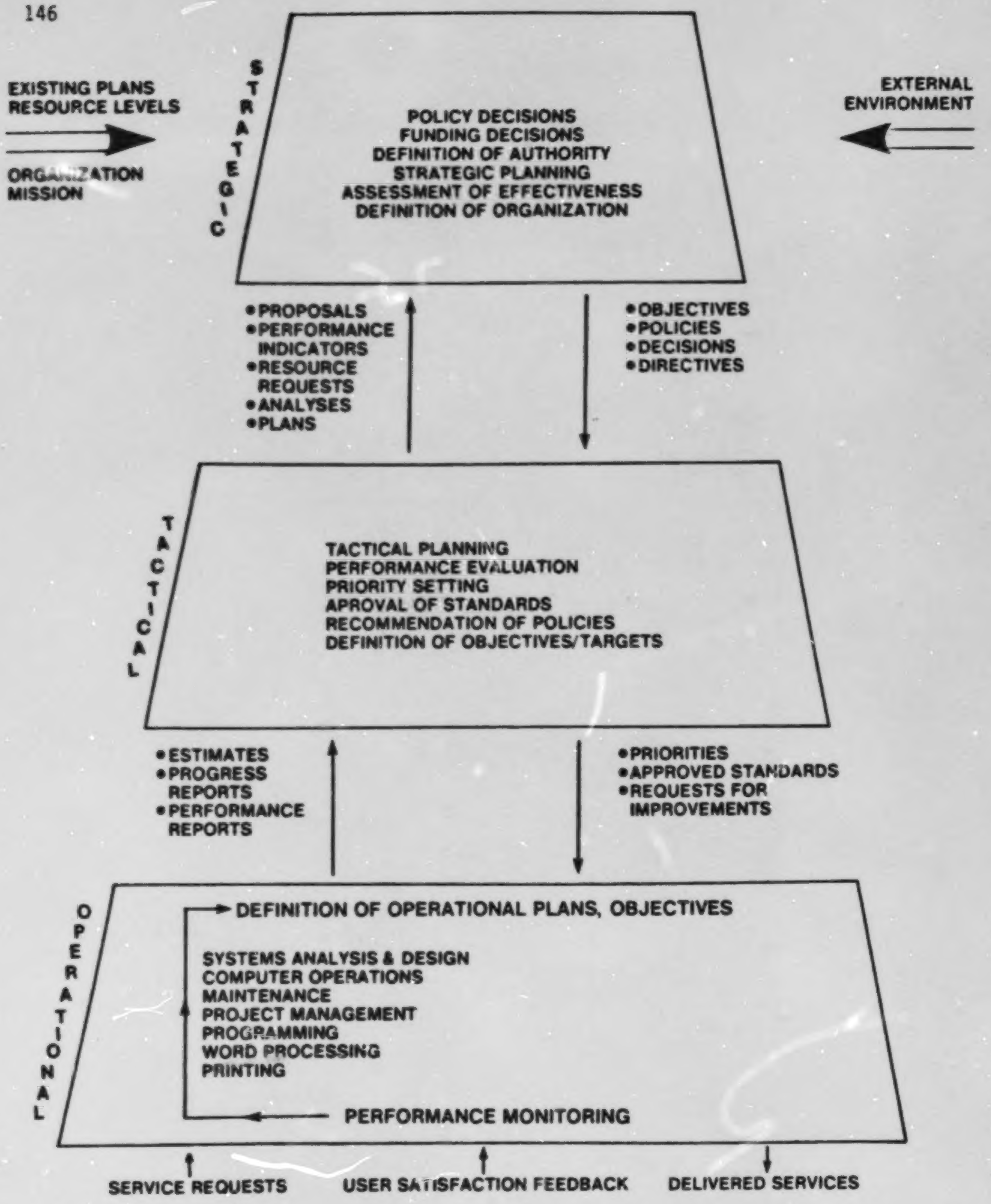
FIG. 2


STRATEGIC
PRESIDENT
EXECUTIVE COMMITTEE
TACTICAL
VP ADMIN. SERVICES
COMPUTER ADVISORY COMMITTEE
OPERATIONAL
DIRECTOR INFORMATION SYSTEMS
MICRO COMPUTER WORKING GROUP
USER GROUPS BASED ON COMMON INTEREST
APPLICATIONS PLANNING COMMITTEES

ORGANIZATIONAL STRUCTURE

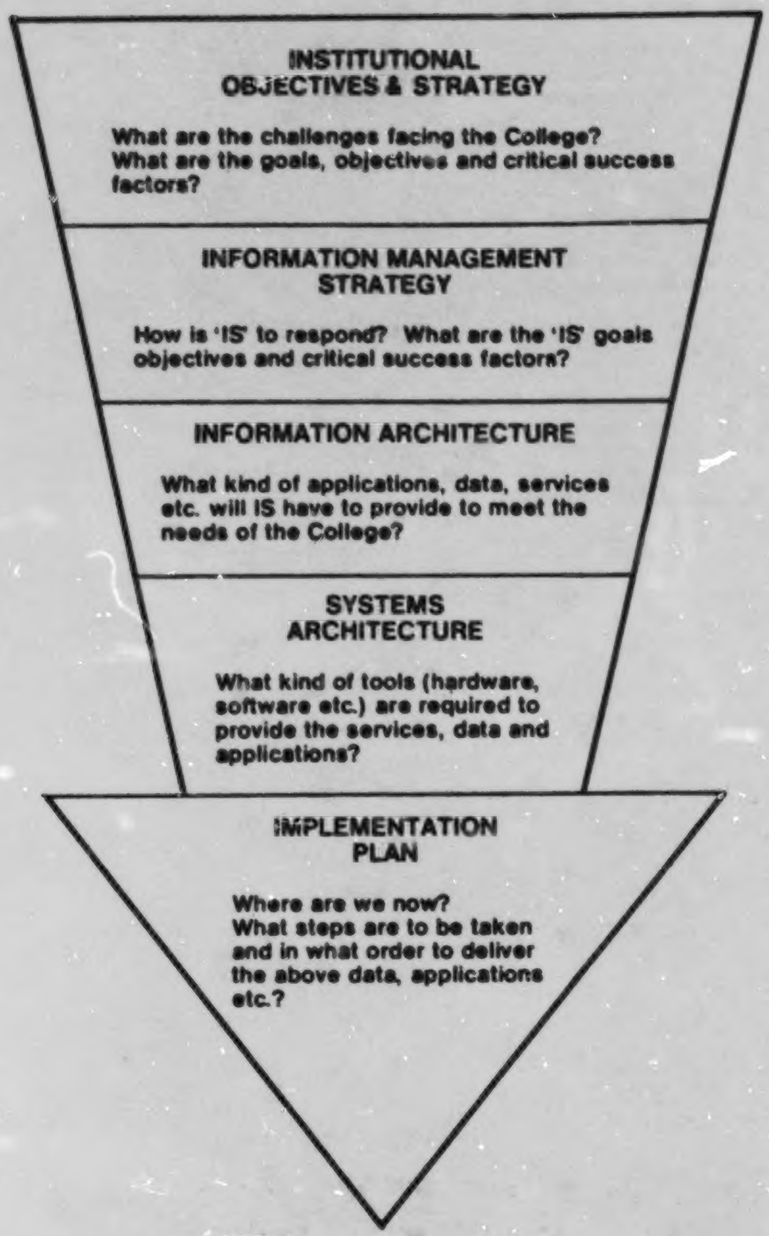
FIG. 3

------ Indicated flow of advice


EXISTING PLANS
RESOURCE LEVELS
ORGANIZATION
MISSION
STRATEGIC
POLICY DECISIONS
FUNDING DECISIONS
DEFINITION OF AUTHORITY
STRATEGIC PLANNING
ASSESSMENT OF EFFECTIVENESS
DEFINITION OF ORGANIZATION
EXTERNAL
ENVIRONMENT
•PROPOSALS
•PERFORMANCE INDICATORS
•RESOURCE REQUESTS
•ANALYSES
•PLANS
•OBJECTIVES
•POLICIES
•DECISIONS
•DIRECTIVES
TACTICAL
TACTICAL PLANNING
PERFORMANCE EVALUATION
PRIORITY SETTING
APROVAL OF STANDARDS
RECOMMENDATION OF POLICIES
DEFINITION OF OBJECTIVES/TARGETS
•ESTIMATES
•PROGRESS REPORTS
•PERFORMANCE REPORTS
•PRIORITIES
•APPROVED STANDARDS
•REQUESTS FOR IMPROVEMENTS
OPERATIONAL
DEFINITION OF OPERATIONAL PLANS, OBJECTIVES
SYSTEMS ANALYSIS & DESIGN
COMPUTER OPERATIONS
MAINTENANCE
PROJECT MANAGEMENT
PROGRAMMING
WORD PROCESSING
PRINTING
PERFORMANCE MONITORING
SERVICE REQUESTS
USER SATISFACTION FEEDBACK
DELIVERED SERVICES

MANAGEMENT FRAMEWORK

FIG. 4



INSTITUTIONAL OBJECTIVES & STRATEGY

What are the challenges facing the College?
What are the goals, objectives and critical success factors?

INFORMATION MANAGEMENT STRATEGY

How is 'IS' to respond? What are the 'IS' goals objectives and critical success factors?

INFORMATION ARCHITECTURE

What kind of applications, data, services etc. will IS have to provide to meet the needs of the College?

SYSTEMS ARCHITECTURE

What kind of tools (hardware, software etc.) are required to provide the services, data and applications?

IMPLEMENTATION PLAN

Where are we now?
What steps are to be taken and in what order to deliver the above data, applications etc.?

INFORMATION RESOURCES PLANNING

FIG. 5

REFERENCES

(1) **'Centralized versus Decentralized Computing:**
Organizational Considerations and Management Options by J.L. King
ACM COMPUTING SURVEYS VOL. 15, NO. 4; p. 319

(2) **'Distributed Processing Systems:**
End of the Mainframe Era?
by J. Breslin and C.B. Toshenberg
AMACOM, New York (1978)

(3) **'Organizational cost considerations in centralized vs. decentralized computing operations'.**
by J.L. King
THE ECONOMICS OF INFORMATION PROCESSING VOL. 2, pp. 68 - 81
J. WILEY & SONS

'Organizing the MIS department'
by J. Milutinovich and H.A. Kenter
IEEE TUTORIAL ON SOFTWARE MANAGEMENT p. 86

'Issues in Centralization'
by C.H. Reynolds
IEEE TUTORIAL ON SOFTWARE MANAGEMENT p. 92

'Managing information systems by committee
by R.L. Nolan
HARVARD BUS. REV. VOL 60 NO. 4 pp. 71 - 79

'What's detaining the office of the future'?
by V. Uttal
FORTUNE MAY 3, 1982 pp. 176 - 196

Evaluation of Computer Center Professional Personnel

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Computer centers pose an array of interesting management challenges: technological change has strong effects and important projects are based within the area. Expectations are high but so are cost constraints. The management of people within the area forms an especially critical concern. Such management processes as recruitment, motivation, retention, and development are absolute sources of organizational health. This paper deals with one of the most important aspects of management, detailing the reasons and methods that make evaluation of personnel so critical.

EVALUATION OF COMPUTER CENTER PROFESSIONAL PERSONNEL

Managers within the computing services environment face an unusual array of pressures: technological change affects them as no other managers; critical projects and deadlines focus on their areas; and in most cases severe cost constraints prevail, resulting from their roles outside of the organization's real business. Colleges and universities increase those pressures because of consistent expectations on the part of administrators regarding the ability of computers to solve endemic instructional and administrative problems.

Hidden amid these pressing problems are a complex of under-emphasized activities that form the real locus of concern for the astute manager. These issues are organizational in nature, involving how and what people should be deployed to deal with computing service activities. I have previously written about selection, motivation, retention, and development of personnel.[1] A further key point is evaluation: the manager's requirement to exercise judgment to ensure that people understand organizational performance standards and that they are given sufficient information to work toward optimum roles within the organization. Because correct evaluation is so easily ignored, it may be the most crucially important part of personnel management and of organizational effectiveness.

Why Should Supervisors Evaluate Personnel?

The obvious temptation is to say that managers evaluate because it is a manager's duty, and leave it at that. But then, duty seldom seems to really motivate anyone, let alone managers. Seven primary reasons for evaluation are evident:

1. Supervisors evaluate personnel because the manager has to exercise choices in the work environment. Many of these choices--having to do with training, promotion, personnel

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[1] Albert L. LeDuc, Jr. "Motivation Of Programmers." CAUSE/EFFECT, May 1980, pp. 28-38.

Albert L. LeDuc, Jr. "Personnel Retention in the College and University Information Systems Environment." CAUSE/EFFECT, May 1981, pp. 4-9.

Albert L. LeDuc, Jr. "Recruitment of Computer Services Personnel for Colleges and Universities." CAUSE/EFFECT, July 1982, pp. 16-19.

Albert L. LeDuc, Jr. "The Development of Personnel in a Computer Services Organization." CAUSE/EFFECT, Nov. 1983, pp. 24-28.

development, salary adjustment, or job assignment--involve very careful judgment. Managers must discriminate between their employees so that these employees can benefit from these choices. If two people are both candidates for a promotional opportunity, the manager who cannot evaluate them carefully enough to come up with the right choice harms the organization, each candidate, and himself. Evaluation involves assessing strengths and weaknesses (and their relationship to organizational need) adequately enough to have a rational basis for choices.

An insurance company executive said:

> One of my toughest jobs is to criticize and to evaluate, but I have learned my lesson. Years ago I had a subordinate turning out mediocre work, but he wasn't outstandingly bad. So I let him drift. By sheer seniority he kept getting small promotions, and at the same time our business kept getting more and more complicated. By the time he was 45 he was in way over his head; he wouldn't accept demotion and was forced to quit. He never had a responsible job for the rest of his life.[2]

2. Supervisors evaluate personnel because people need to know how they are doing. The manager who assumes that his people or his organization can pick up signals from the atmosphere is the manager who invariably has a confused and depressed organization. Not only must the manager communicate organizational and individual standards, but he or she must tell people where they are on the road to excellence. Where improvement is needed, it must be explicitly stated. Frequently, such counseling can stimulate an employee to set work-related goals for himself.[3] Many studies have indicated that personnel in computer services organizations generally feel ill-informed about goals larger than the day's work. A frequent complaint is that they are not informed about their own work or about the context in which that work resides.[4] It is true that an informed employee can be a motivated employee.

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[2] Mortimer R. Feinberg. "Is The Performance Review a Threat or a Promise?" Effective Communication on the Job (New York: American Management Association, Inc., 1963) p. 238.

[3] Claude S. George, Jr. Supervision in Action: The Art of Managing Others (Reston, Va.: Reston Publishing Co., Inc., 1977) p. 167.

[4] Jac Fitz-enz. "Who is the DP Professional?" Datamation, Sept. 1978, P. 126.

3. Supervisors evaluate personnel because evaluation is a form of management interest[5]. Personnel researchers frequently cite the "Hawthorne effect" in noting, sometimes cynically, that employees show performance improvement whenever management shows any interest whatsoever in the work process. Rather than succumb to this view, the manager who is doing a good job is interested in work process and the people within that process because he or she is interested. That interest should be manifested in the mutuality of any formal evaluation; mutual goal-setting can easily be a part of an annual appraisal, for instance. If the organization is committed to "management by objectives", the whole motive of standards and performance measurement is forced into areas of mutual interest. The evaluation process should encourage an employee's commitment to organizational goals.[6] Furthermore, when a manager uses some formal means of evaluation, he or she is "showing an interest in an employee's potential for training and development",[7] an interest which cannot fail to be motivating. Computer services employees seem especially amenable to development suggestions, probably because of the nature of the rapidly changing field.

4. Supervisors evaluate personnel because of the feedback the supervisor receives. Clearly, the person being evaluated receives feedback in any healthy evaluation process; less clearly, evaluation is a means for the evaluator (supervisor) to receive feedback. Feedback can come directly, as people express what they expect management to do to aid them in achieving goals. It can also come indirectly, as management uses evaluation as a set of milestones to determine how well organizational or technique change is working. Are people responding to earlier nudges in the evaluative process? If not, is it supervisory technique that is at fault?

5. Supervisors evaluate personnel because it helps them in tactical and strategic planning. Short-range planning is frequently done "on-the-fly"; for example, a special data base theory class is being offered and a choice must be made as to who can most benefit from attendance. Personnel development is a continuous process, dependent on some form of evaluation to ensure results.

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[5] Saul W. Gellerman. The Management of Human Relations (New York: Holt, Rinehart and Winston, 1966). pp. 28-29. The original Hawthorne experiments are described in the literature in many places, most notably in books by F. J. Roethlisberger.

[6] T.A. Rodman, "Make the Praise Equal the Raise," Personnel Journal, Nov. 1984, p. 73.

[7] George, op cit, p. 162.

The data processing manager faces a very difficult job with evaluation; for despite solemn professional advice to "measure only against what a job requires, not what you think a person can do",[8] evaluation must necessarily deal with potential growth. The computing field is so dynamic that the ability to grow technically is a key part of evaluation. Tomorrow's job requirements loom over the evaluation process.

6. Supervisors evaluate personnel because evaluation assures equity. Helping maintain fair relationships within groups is one of the most difficult burdens evaluation bears. Evaluation involves a set of judgments: about relative skill, about promotion potential, about attitude, about ingenuity. Thus, it can be seen that the value structure is many-dimensional, and yet, the manager has to make distinguishing judgments. No one else is called upon to try to defend equity in quite the same way. Why did Sally Roe get an upgrade and Billy Boe stay as a Programmer I? What factors cause Charlie Coe to make $5000 in salary more than Larry Low? Equity is a difficult topic, but it should be easier for the manager who has evaluative data available; at the very least, he or she should be able to defend equity decisions with a reasonable rationale.

7. Supervisors evaluate personnel because they seek merit distinctions. As Lionel Lewis has said in the _Chronicle of Higher Education_, "there is no more common watchword in academe than merit".[9] Lewis is primarily referring to merit as utilized in the promotion and tenure decisions confronting those in academic ranks. But I think that we are liable to see the same emphasis given merit in the computing professions, in or out of the college community. The reason is plain: meritorious performers in data processing have unusual leverage on the organization. However, even without counting the effect of their work, all managers know that a skilled programmer, for instance, can out-code a mediocre programmer by a factor of 10 or better. The manager and organization that ignores differences of this magnitude is asking for consistent mediocrity.

   Merit evaluation also specifically refers to merit pay recommendation. For various reasons, merit pay has actually been slow to develop in colleges. However, "the trend in the United States is toward somewhat more emphasis on merit for pay increases and other personnel actions. Merit is especially favored by persons with higher education, by persons in complex jobs permitting variations in quality of performance, and by younger employees...."[10] People in computing services' professional and technical positions qualify on all counts.

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[8] George, _op cit_, p. 168.

[9] Lionel S. Lewis. "Trying to Define 'Merit' in Academe," _The Chronicle of Higher Education_, July 18, 1984, p. 56.

When Should Evaluation Take Place?

The effective supervisor evaluates two ways: periodically (at least annually) and continuously. These two ways have decidedly different purposes. The periodic evaluation may be required by the organization as part of a formal appraisal system. The continuous evaluation is the manager's set of checkpoints through which he or she constantly seeks performance improvement for the organization.

I am not particularly concerned with the form of the annual evaluation. For one reason, most line managers have an instrument and a methodology dictated to them. There is little benefit in trying to start a debate about the theory of personnel administration forms.[11] For another reason, most of the advice that managers get on the subject of evaluation is specifically directed toward the periodic performance appraisal. Although the periodic performance appraisal is a focus for personnel evaluation, I hope to convince the reader that it is not the be-all and end-all of evaluation.

Outside of the formal structure of a periodic performance appraisal, how can the manager evaluate? The manager evaluates each time he or she becomes analytic about the capabilities and progress of the people in his or her organization. For the energetic manager, those times should come often. Every time the manager muses about personnel, some form of evaluation takes place:

- should that program have taken as long to code as it did?
- is that analyst developing a better rapport with his user than he had?
- does that programmer need additional training in debugging tools?
- why is that supervisor's work group increasingly ineffective?
- have those two programmers divided the labor on this project correctly?

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[10] Keith Davis, Human Relations at Work: The Dynamics of Organizational Behavior (New York: McGraw-Hill Book Company, 1967) p. 422.

[11] See Roger Bellows, Psychology of Personnel in Business and Industry (Englewood Cliffs, NJ: Prentice Hall, Inc., 1961) pp. 370-389. This provides an excellent overview of the theory involved in formal evaluation or appraisal programs, although the recent emphasis on evaluation based on management-by-objectives is not included.

- should something be done about that programmer's disruptive anger?
- are we utilizing that programmer's talents right by keeping her on the project she's on?
- is that operator really capable of running a maintenance shift by himself?
- should that systems programmer be sent off to school on telecommunications access methods?
- is that programmer's interpersonal skills adequate to ever become an analyst?

With practice, such questions are asked of oneself more and more often. A key point becomes measurement. Managerial analysis should yield increasingly precise quantitative and qualitative measures of performance. Every event becomes grist for the observant manager's mill. Too often, by the way, managers apply specific evaluation only to employees who have drawn negative attention and are on probation. A more appropriate habit is to continually question even the accomplishments of the achieving performers. Equivalent effort spent evaluating the "stars" might gain bigger yields. After all, concentrating attention on them is a high-leverage activity. If the "stars" get even better, the impact on group output is very great indeed.[12]

Another general argument for continuous assessment is that there is no way to measure the work most computing services professionals do on an arbitrary calendar boundary. Most such jobs involve activities that are not reflected by output in the period covered by the review. For instance, a programmer needs to complete a project on a strict schedule to meet some vital organizational requirement. But it is also the case that he or she is working on a design method that will benefit the maintenance of this program in later years but which slows down the development effort. Obviously, only some form of continuous evaluation can take into account the opposing objectives that will affect this programmer's performance. An evaluation that is timed so that the deadline failure is emphasized over the long-term benefit is not fair.

How Should the Manager Conduct Evaluation?

Of course, a good bit of evaluation is interior monologue, as should be clear at this point. But there are some forms that are important to emphasize:

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[12] Andrew S. Grove, "Employee Appraisal: When You're the Judge," Computer Decisions, May 1984, p. 248.

1. Evaluation should proceed from understanding the job to understanding the person in that job. Some studies have shown that there is a coincidence of as low as 30% between tasks that a person thinks he should be doing and tasks that the supervisor thinks he should be doing. As Mortimer Feinberg says: "often we blunder in appraising a man's performance because we have superficial ideas about his job which he does not share and perhaps may not even be aware of".[13] If, for instance, we expect a systems programmer to code a complicated security exit in our teleprocessing system, we cannot evaluate progress on that task by disregarding the time and effort necessary to keep the production system going at the same time. It is a painful truth that management is forced into long-range concerns, while workers are usually fighting fires. Too often, the gap between job reality and management view is inadequately bridged. As Robert Hoppock points out, by active listening the supervisor can learn more about the real job, so that standards by which performance can be evaluated can be mutually understood.[14]

   Once the nature of the job is clear, understanding of the person in the job can proceed.

   How well does this person do all of the defined job?

   Are there ways in which his or her talents can be better utilized in that job?

   Can this person grow in the job as presently constituted?

2. Evaluation must (at least) attempt objectivity and seek to avoid bias. The irony is that judgment is ultimately subjective, and yet fairness demands objectivity insofar as is possible. To what does the supervisor compare a person's performance? Is it some abstract standard of perfection, in which case isn't it difficult to standardize "perfection"? Is it the performance of others in the department? Is it the individual's own past performance?[15] Data processing jobs are frequently beneficiaries of the so-called "halo effect", by which is meant that all people who stand within the aura of a saint (or a particularly talented systems analyst) are thought to be similar. There is apparently an analogous "horns" effect as well. Managers also may have a tendency to either be consistently lenient or consistently

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[13] Feinberg, op cit, p. 236.

[14] Robert Hoppock. "Seventeen Principles of Appraisal Interviews." Effective Communication on the Job (New York: American Management Association, Inc., 1973) p. 242.

[15] Davis, op cit, p. 418.

strict, thus biasing any sort of standard comparison, even if it occurs only within the manager's mind. Some formal appraisal systems are influenced by organizational experience into bizarre standards; for instance, there are examples cited in personnel literature of as much as 98% of a given population being rated as "satisfactory" while an overall rating of "outstanding" or "unsatisfactory" is shunned.[16] The hypothesis is that management in that situation encounters animosity, disruption, or defensiveness with any rating other than satisfactory. Another cause of a rating system that tends toward "average" evaluation is the supervisor who does not know either the jobs or the people he is evaluating well enough. Any manager who experiences this tendency ought to examine the level of his or her understanding of the area he or she is supervising.

Objectivity is also spoiled by end-use bias: what is any evaluation to be used for? If for merit pay considerations, for example, managers tend to evaluate quite graciously.

3. Evaluation deserves a private dialogue. Some form of sit-down counseling needs to be a part of evaluation. Most evaluation systems force such a setting, usually as a conclusion to the performance appraisal exercise. Personnel literature is filled with excellent summaries of tips the manager needs in order to be able to construct the appraisal interview process correctly.[17] There is an interesting consideration about whether such an interview should start with a formal self-appraisal. That is, should the evaluatee present his own view of his job performance to the evaluator as a starting point? Some people maintain that it provides a way toward mutual job understanding. Others claim that it abandons management responsibility and leadership. In any event, a dialogue must take place. This dialogue requires the development of rapport, a willingness on both parts to listen, and an atmosphere conducive to recognizing and solving problems. This requires attentiveness and a modicum of privacy. It requires frankness, carefulness with any criticism, specificity, and seriousness.

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[16] James G. Stockard. Career Development and Job Training (New York: Amacom, 1977) p. 339.

[17] In addition to George, Rodman, Hoppock, and Grove, all cited in earlier footnotes, excellent and specific tips are given by the following:

Donald Kirkpatrick. How to Improve Performance through Appraisals and Coaching (New York: AMACOM, 1982) pp. 45-60.

Donald J. Berardo, "Guidelines Offered for Appraisal Reviews," Computerworld, June 13, 1983, p. 69.

4. Evaluation may require forced choices. Perhaps the most stringent form of evaluation is that which does force choices upon us: for instance, who are the top 5% of the department that will get merit raises? Who are the bottom 5% that must be laid off? Up to a group size of about 20 people, there are some forced-pairing or scoring techniques that can be used to force a rank-order for this type of evaluation.[18] In business, this is sometimes called "lifeboat order"; the metaphor invoked by that phrase is to imagine the department on a lifeboat drifting in the sea. Inadequate supplies are available, so as the days go by, there is some agreed-to order by which all people in the lifeboat will be thrown out. Theoretically, the "lifeboat order" ranks people in the order of their importance to the enterprise. As cruel as "lifeboat order" really sounds, such a ranking offers the manager the real exercise of comparing differing values. Is George, an analyst of lengthy experience, really of greater value to the organization than Sam, one of the programmers working under his direction? If so, why? Is it in the nature of the analyst's or programmer's job, or is it because of perceived capabilities in the people? Can either the jobs or the people be changed? One sobering realization is that "lifeboat order" ought to be the same as salary order, if all decisions regarding salary have been rational.

   "Lifeboat order", in a project-oriented environment (for example, in a systems development area) tends to be affected by the serial nature of projects. When projects approach critical deadlines, people who are crucial to the progress of the project obviously rank higher in the "lifeboat order". Clearly, organizational realities may influence an otherwise-abstract evaluative process.

5. Evaluation is a judging process. Anyone who has participated in a formalized judging system, be it for cattle, flowers, or dogs, understands and uses a formal scoring methodology. There are two things of interest about this. First, a set of weighted scores determines _a priori_ the mix of qualities that will be judged. This not only permits analysis, by breaking the object up into its component parts, but it prescribes the relationship of these qualities. (Exactly how much more important is form than color when judging a flower?) The second point of interest is that the sum of the various quality scores determines which object is actually better or closer to perfection. And that is the essence of judging. I wouldn't dream of extending this technique or level of analysis to human beings, but the principles are still of interest: evaluation is a process of judging. Judging involves the determination of the relative importance of various characteristics and a corresponding value judgment involving how well the judged object meets those characteristics. Managers do precisely the same thing when they evaluate a job and then measure how well a person fits that job.

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[18] Bellows, _op cit_, pp. 380-389.

Summaries

Evaluation is one of the most important personnel activities the manager engages in. Without evaluation, the manager allows the organization to drift, with no clear indications of performance standards or of progress people are making toward better capability or value.

Evaluations can be informal, a by-product of "management-by-walking-around", or formal, as a focal point of a personnel appraisal system. They should be both periodic and continuous.

Evaluation is especially important for computing services managers because the development of top performers is such a high payoff strategy. Training and job assignment ought to be tailored to the proper individual's needs.

Evaluation is by nature analytical. Both the job to be done and the person to do it should be analyzed; that is to say, examined by component parts.

Evaluation is, finally, a means to some end. It may be used to determine pay equity, to suggest personnel development, or to restructure jobs to fit evolving capabilities. Personnel evaluation in a methodical way leads the manager toward a better understanding of people in his organization and their potential.

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dw

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Managing the Information Resource

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DISTRIBUTING COMPUTING IN THE 1980'S: LESSONS FROM A LATECOMER

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ABSTRACT

Driven by remarkable changes in both the technology and the user community, university administrative data processing is moving towards a more distributed environment. In the case of a multicampus institution beginning to explore the needs and options of the 1980's, the challenge is to develop an approach that supports user independence and access to data while maintaining traditional requirements of accuracy and efficiency. An architecture must be established that incorporates central sites, campus centers, and end users in a networked pool of computer systems, with applications located at appropriate nodes in the network. This presentation will examine the current options for such developments.

I. Introduction

The distribution of computing has been a significant process within higher education for over twenty years. In both the academic and administrative sectors, universities have evolved new and important paradigms for computing organizations and networks. During this time, the forces driving these developments (primarily technology and user needs) have undergone dramatic changes and produced changing approaches in both the meaning of distributed processing and the architectures that result. Planning to distribute administrative computing within a multicampus university today presents unique challenges. Designers must distinguish the differences between academic and adminstrative computing, understand the complexities of the multicampus environment, and anticipate the changes in technology and needs. Architectures must work not only on a technical basis, but also within the political and financial realities of the institution.

This paper begins by discussing how distributed computing is affected by the basic factors described above. In particular, entering into distributed processing in the mid 1980's poses a set of options far different than those available in the 60's and 70's. The technology has changed remarkably; users have different needs and expectations; the existing base of systems and data have grown considerably. Local conditions, of course, will have significant impact on possible architectural models.

We will then explore the specific questions faced in distributing administrative systems today in a multicampus environment. The process begins with agreements on the basic values and assumptions that will be fundamental to the evaluation of the options. The options themselves are built on basic analyses of the compatibility and access needs of the institution, its existing systems, and local conditions. The paper concludes with a discussion of the flexible, loosely-coupled administrative computing environments that will emerge in the next few years.

II. PRIMARY DESIGN DISTINCTIONS

Distributed processing began in the academic sector. With the advent of the first laboratory computers (eg. PDP 8's, HP 1000's) in the mid 1960's, there was the oppportunity to place computational engines in close proximity to a researcher who needed the resource and was not intimidated by the task of programming one of these beasts. Such early ventures illustrate some of the basic forces tha still fuel the drive for distributed computing: the ability to work or customize a system to one's own needs, the efficiency of having hands-on access, and the pride of ownership.

Academic vs. Administrative Computing

There are several important reasons why distributed processing began in academics rather than administration. These reasons emerge today as key concerns in adapting distributed processing to administrative systems. First, in the academic sector there is limited sharing of data. The creator of the data is most often the only one who wants access to that information. Secondly, the intent of the academic is the result of manipulations upon a data base, while the administrator is more often concerned with the data base itself (and its maintenance). Thirdly, the emphasis in academic calculations is on doing "it" a new way where administrative requirements are for stability and doing "it" every day. To a degree, academic systems are often less complex than administrative systems, though the complexity of administrative systems is due more to their size and scope than to the nature of the calculations within. Lastly, security is of lesser importance in the academic sector.

Single vs. Multicampus Distinctions

Within any organization there will be differences in operations and policies. On a single campus, these anomalies will be minimal, reflecting perhaps different drop/add procedures but generally not extending to different payroll procedures or budget systems. In a multicampus environment, however, there often arise distinctly different major systems, reflecting local conditions, degrees of autonomy, and academic orientations. Developing software that copes with these differences can be difficult. Not only does the complexity of the packages increase markedly, but the local campus requirements may be mutually contradictory. Allocating costs and resources among the campuses may be contentious.

Industry vs. University Settings

It is tempting for higher education to emulate the distributed solutions being developed in industry, but there are major differences in the two environments. There are usually far more brands and styles of computers in the university than in industry. The resulting incompatibilities require networking techniques and products that industry has little experience with. Secondly, industry tends to have a strong management structure that can impose compatibility requirements, control authorizations and other clarifying policies. The intellectual freedom of academia spills into the political and technical areas; protocols must be nurtured rather than ordained. Thirdly, university users tend to be more educated than their peers in industry. This increases both their desires and their capabilities, which are fitting factors to encourage distributed processing.

Moving Targets

There is an old proverb: "The nature of the solutions determines the nature of the problem." The changes over the last thirty years have affected the perception of what needs to be done as well as how to do it. Three major areas have shifted: technology, user expectations, and embedded bases. The changing technological options available to systems architects form the basis of any solution. The most important technological trend has been the shifting cost ratio of cycles to communication bandwidth. In the fifties and sixties, the cost of cycles far exceeded the cost of bandwidth to remote sites; the only reasonable architecture was to distribute access through rje stations and occasional multiplexed terminals. Now, the relative expense lies in the communication medium; at the remote end, the intelligent terminal that superceded the dumb RJE has in turn been upgraded to a pc with terminal emulation. New architectural options include distributing cycles and distributing data. As software matures, distributing systems is becoming a viable option as well. All these options reflect the increased ratio in the cost of moving data to computing with that data.

Perhaps the most critical changes over the last thirty years of decentralization have been in the relationship between users and their data. The priesthood of computing is gone; users are far more mature and demanding in their need for information. Administrative computing has grown into three categories: data processing, data analysis, and office automation. Data processing refers to the base systems most concerned with record keeping, e.g. admissions and records, payroll, and billing and receivables. Data analysis is the use of those base systems for analytic or descriptive reporting. For example, enrollment trends, salary savings estimates, and budgetary projections are activities that aggregate individual data into meaningful statistics. While some base systems allow such calculations, in general these analyses are performed by extracting data from the base databases into a utility like spreadsheets or forecasting packages. Office automation includes word processing, spreadsheets, simple database applications, and communication. Recognizing and dealing with the increased needs and capabilities of the user is a primary consideration in distributed processing.

The third new consideration in distributing administrative systems now is the embedded base. Considerable hardware, software and databases have sprung up in central sites over the past years. What to do with this material, and what compatibility restrictions it imposes are primary questions the architects must resolve.

Local Conditions

The diversity of existant multicampus administrative computing structures is indicative of the significance that local conditions have on the architectural options. Typical factors include role and mission of each campus, resource disparities and support capabilities of each local site, operational differences between campuses, and even geography (which is reflected in the relative costs of moving data). After the more theoretical design stages, it is such specific institutional aspects that shape the final architecture.

III THE DESIGN PROCESS

For computer systems, as for all complex constructions, there is a rather ordered set of stages that the architects pass through. For multicampus administrative systems in the '80's, those stages begin with a clear goals definition and an associated agreement on what the scope and exclusions of the project will be. Basic assumptions need to be explicitly stated and shared, no trivial task in a rapidly changing technological and social environment.

VALUE SETTING

Much of the work in any design process lies in obtaining general agreement on what needs to be done and why. In the design of a new system, there is a conspicuous lack of experience and a surplus of buzzwords on what needs to be done. Scope will define exactly what the requirements are and exclusions are used to identify those issues (technical and political) that aren't on this agenda. Such ground rules prove important when the discussions get muddied.

In particular, there must be agreement on why to distribute. To be sure, there are significant reasons to distribute, but there are also some myths that need to be identified. There are some clear reasons to distribute computing: (1) There are many simple computing tasks that the user can do more efficiently than a central staff. (2) Local control leads to more local responsibility. (3) Systems that address only local operations are simpler and easier to develop and modify. (4) Local centers are more responsive to local concerns. (5) There is increased user satisfaction in fuller participation in their computing.

There are also some distinct myths: (1) Distributed computing saves money. There are clear monetary economies of scale to a central site, even with changing telecomm/cycle ratios. Although distributed computing does offer significant economies of time as well as enhanced service and morale, any attempt to factor in these savings on a monetary scale is mere fodder for debate. (2) Distributed computing is easier. In fact, it asks a lot more of end-user and local site, but that is part of the attractiveness. In general, the skills developed are desirable and enjoyable ones.

DESIGN ANALYSIS

Many of the important design issues fall into several groups: compatiblitity issues, location and ownership of data, financial and political considerations, and the changing roles of the central and local sites.

Compatibilities

The current computing environment now offers a remarkable set of options for the interactions of different machines. There are two venues in which to consider compatibility:

locus of compatibility: intercampus or intracampus.
type of compatibility: hardware, software, or data.

The locus has significant impact on support loads. Compatibility within a campus (more specifically within the unit performing the bulk of ADP computing) can utilize local expertise. In addition to the savings on support costs, local compatibility leads to redundancy and reduced points of failure. At one campus in the UC system, distinct academic and administrative systems can swap components, which creates a flexible environment where non-stop administrative computing can occur without much cost. Compatibility between campuses passes support more to a central site, with the resulting economies of scale. Additional benefits include ease of networking and communication, and possible vendor discounts. However, there is little likelihood of swapping data, components or software in the case of failures.

Compatibility in hardware, software and data is an issue in great flux these days. Options, sometimes genuine and sometimes vendor-inflated, are expanding as the technology rushes forward. Hardware compatibility provides the options for dynamically modifying configurations as needed. Single vendor solutions also offer easier networking and communication. (Of course, hardware compatibility these days no longer requires single vendor allegiance, as the clones can attest.) Compatibility of software, however, may be the more important feature in the mid '80's. Software compatibility not only reduces system support needs, but minimizes the user's learning curve. Keeping this consistency (in query languages among different databases, for example) will be increasingly important as we ask our users to assume more of the responsibility and control of their information. Software compatibility also reduces the need for hardware compatibility; Unix applications really do port well and MS-DOS machines can all provide the same Lotus (although relearning function keys may be annoying.) Data compatibility is almost a sine qua non now. We need to be able to move our spreadsheet print file into word processing and our mail from the mainframe onto our own micro for editing. Utilities must be able to handle external transfers of ASCII files (this paper has made four transitions of systems) and systems must be able to provide for error-free exchanges.

Ownership, Location and Access of Data

As a result of the growth of administrative computing, three distinct classes of data have evolved: individual data - typically the record-keeping primary databases; aggregate data - the results of institutional research and data analysis on those data bases; oa data - the electronic communications, documents, and applications in the office automation activity. These data classes can be measured against three separate data-related issues: ownership, access, and location. Ownership of data is now best assigned to a single user or department, who can then control access rights. Ideally, both access and ownership should be on a per field basis, although most software now only offers record or database permissions. In order to facilitate use, access rights can include read-only on individual items, update on individual items, or a new grouping called aggregate access. In the latter case, a user has permission to perform certain statistical operations on the data as long as the anonymity of the individual is preserved; such access satisfies a great deal of the data analysis needs of our users. As for location, modern technology provides a wide range of machines, each with certain strengths. The optimal structure is for the university to provide a hierarchy of networked machines, where computational tasks occur on the most appropriate vehicle in the "computer pool". This suggests that record-keeping run on a machine that can handle the magnitude of the task, and that more interactive data analysis applications can run closer to the user.

Financial and Political Issues

Any redistribution of administrative computing support funds will directly affect the ability of the local sites to sustain their increased load. Moreover, the total institutional support for computing must rise too; distributed processing tends to cost more. Once base level funding has been established, one-time capitalization and ongoing costs must be allocated.

Most of the political concerns arise directly from local conditions, but several themes are certain to occur. Distribution of systems leads to distribution of control. Reporting lines may need to be revised or matrixed. A second issue is the access of local data by the central authorities. Where once their access was pro forma, the central site must redefine their access needs and rights. Yet another issue is implicit in any network - balancing the "good" of the network against individual campus needs. For example, a communications network depends upon widespread use for its success. A campus or department that cannot afford the linkage may need to be subsidized; another unit that may have its own separate mail system may need "encouragement" to link to the central system as well.

The Changing Roles of Central and Campus Sites

While some of the specific functions performed by these sites depend on the specific architecture adopted, certain new roles will invariably evolve. Most of all, both sites must provide the electronic and political environment for communication. The need for both intracampus and intercampus electronic mail will continue to grow rapidly. Secondly, the central site will need to provide considerable local campus support and education. The campus sites will have a rough transition, and the central site has vital experience with the operation of existing systems. Similarly, as the local distribution occurs on campus, users will need support, classes, and occasional salvation from the campus site. Coordination of individual efforts (an informal sick-leave and vacation spreadsheet template became a campus standard when adopted and distributed by the local site) and nurturance of some standardization of software and hardware (through group discounts and common maintenance) are examples of the positive influences that can be developed on the campus. Bailouts should be provided for users who bite off too much. At one campus, we run the same database and spreadsheets on our mainframe as on many of the micros. When the continuing ed micro-based contact base grew to 20 floppies, the central site merely chided the unthinking developer and then moved both the programs and the data up to the mainframe; in an hour the developer was back in better business. The publicity didn't hurt, and the value of coordination was reinforced.

IV. CURRENT OPTIONS FOR DISTRIBUTED ADMINISTRATIVE ARCHITECTURES

Several basic approaches emerge as possible paths towards distributing administrative systems in the mid '80's. Note that the validity and the character of the approach for a particular institution depends heavily upon unique local conditions.

Soft systems

Soft systems refer to architectures in which campuses only hold replicas of a central database. Typically, a subset of a database is downloaded each night to a campus system; during the day that database is used in a read-only mode, with users making inquiries and performing statistical summaries either on the campus system or on copies that have been further downloaded to micros. Writes are done either directly on the central system or stored as batch commands for a nightly update of that central database. During the day, the campus copy ages and becomes unofficial, limiting the type of work it can be used for. Soft systems thus are an attempt to distribute many of the benefits of distributed processing without actually distributing the primary data.

Another appealing aspect of soft systems is that they allow several layers of distributed processing; each layer has an appropriate soft subset of the upper databases. Users have full reign to exactly the data they have the right and need to know, in an environment that encourages them to develop effective solutions to their data analysis needs. Soft systems also allow the creation of new streamlined local databases, as the batch programs that extract the data from the central systems can correlate across files and supress superfluous fields. Lastly, soft systems can accomodate soft data. For example, when an administrator sends out a purchase request, he can enter into his soft budget system an approximate total cost; to revise this number when more accurate information arrives does not require an audit trail and forms in triplicate. The user modifies his own data as needed. Such soft financial systems often may be more accurate than the official batch system with its monthly updates and bureaucratic lags.

The most obvious drawback to soft systems is that they are soft. The data is not guaranteed correct. While this may be fine for aggregrate figures, ball-park estimating, and government work, the student who changed his registration today can't be accurately viewed by other departments until tomorrow. Thus, they in no way alleviate the need for official central systems, and so can be viewed as a lot of overhead (though clever construction locally can minimize the overhead). Soft systems also have less value in a centralized system that possesses flexibility and good data analysis tools.

Distribute in parallel

This architecture refers to a complete migration to campus sites. Copies of centralized software and data are migrated en masse from the central systems onto local machines. Users then run the same "centralized" systems, except on local machines. Additional applications can then be developed locally and perhaps shared with other campuses. Unlike soft systems, the local campus copy is the offical copy. Central copies of databases may be maintained, but in general central interactions are limited to periodic batch updates of certain aggregated data. Most of the difficulties implicit in this approach stem from interactions between campuses, such as students enrolled at multiple campuses. The California State University system has utilized this architecture.

Distribute in series

This architecture represents a gradual transfer of systems and their databases from the central site to the local campus. This can be done by shifting existing systems or implementing new systems (or upgrades) only on local machines. While the phased apporach offers obvious benefits in the stability and quality of the transition, there are problems in sequencing the distribution of systems. The interaction of databases in the typical university environment is quite complex. Moving a student registration system to a local computer presents difficulties if the billing system remains on a central machine; personnel databases need to interact with financial reporting systems, etc. Providing interactive communication between distributed systems is expensive and inefficient. One alternative is to install batch interfaces between the databases that have moved and those still to come. Batch interfaces can be added into existing systems with a minimum of disruption or threat to security. For example, moving a student registration system and database may sever an interactive connection with the billing system; instead of immediate student billing at registration, a tuition calculation is done by the registration system, but the official bills are now mailed out. The University of Tennessee is an example of distributing in series, where SIS systems are distributed to individual campuses and interface to central management and budget systems.

V. CONCLUSIONS

The role of centralized administrative computing is changing rapidly as both the technology and our users mature. The forces that have driven the distribution of academic computing need to find their appropriate form in the administrative areas. The role of the centralized site being the repositor of all information is being revised into one of a coordinator and facilitator of our users and "their" information. Certain base level record keeping may continue to reside centrally, but there is a steady movement of the analysis of those records towards the user. Similarly, the two-tier model of priest and end-user is evolving into a multi-tier relationship. A heterarchy of central site, campus site, departmental or college site, and end-user (with additional layers possible) is growing in both hardware and software. Unlike business, where corporate bylaws insure some compatibility of systems and intents, the university represents a cacaphony of brands and agendas, often with significant inequities among the resources our end-users have.

It is critical to develop an architecture that delivers both the power and the responsibility to the end-user. Delivering that power requires giving cycles, application development tools, and date directly into their hands. At the same time we must nurture their education, remind them of the costs of sloppiness, increase their skills and sobriety, foster compatibilities where possible and develop retrofits when needed. In turn our users will become more aware in their use and understanding of the power and limits of computers. As end-use increases, users will find that their use of the central site also increases, though the types of use may change. The worth of the services, communication and coordination that we can provide will emerge. Both users and their computing centers will get better.

INFORMATION CENTER PROJECT ASSIGNMENT GUIDELINES

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ABSTRACT

The information center offers an alternative to formal application systems development. The application development backlog makes the IC approach attractive. Yet needs for organizational control of data, auditability, and backup may imply formal development. Specific guidelines are needed to select the right method early in the user's contact with the MIS department.

This paper presents the guidelines used at Loyola University of Chicago. Loyola started its Information Center in 1980, and reported its early experiences at CAUSE '81. The guidelines are matrices that link to other matrices. For example, a two-variable matrix has a vertical axis called "scope of data" and a horizontal axis "type of application". Cells contain "ICS", "SD", or an asterisk which means that another matrix must be used to discriminate. The final result of a path through the matrices is "ICS", "SD", or management review required.

Guidelines for picking either the mainframe or a microcomputer for the project are also presented.

Information Center Services at Loyola University of Chicago

Loyola University of Chicago formed a special service team called Information Center Services in 1980, before the concept was widely accepted. At that time, ICS consisted of one systems analyst in the Systems Development Department. The concept proved to be a good one; some of the early successes were reported at CAUSE '81 and in the September, 1982 issue of *CAUSE/EFFECT*.

At its inception, ICS supported small mainframe applications only, like databases in FOCUS, decision support and graphics in SAS, and word processing with SCRIPT. ICS is now responsible for administrative uses of personal computers and word processors, as well as these small mainframe systems. The team is now headed by its own manager, and consists of two analysts, a microcomputer specialist, and eight part time staff. The organization structure is shown in Figure 1. The direct relationship to the Director of Academic Computing Services helps share the computing facilities of Loyola's three campus, the educational resources, and common mainframe software and microcomputer support staff. In particular, the ACS/ICS department is responsible for all personal computing standards and support in the University.

The "dotted line" reporting relationship of the ICS manager to the Director of Systems Development is primarily for project approval. The Systems Development department consists of five teams, each of which is dedicated to a functional area of University administration, for example, Financial Information Systems. All new ICS projects are approved by the systems manager whose team would be responsible for the user's office if the project were developed by large-scale development methods. This insures that an existing operational system, say the general ledger system, does not already provide the function the user is seeking. Such approval requires a review of the ICS analyst's decision that the user's needs are best served by ICS's tools and not by formal development methods. It also keeps the large systems manager aware of small user databases in his area. The review requires the systems manager to validate, in cases of reports and extracts from major database, that the user's expectations can be realized by appropriate use of the data. This is especially valuable when reporting from databases designed some years ago, which have limited data dictionaries. The Systems Development Director and ICS Manager personally discuss cases in which there is a dispute as to the proper method of service, projects for which the user does not have a systems team, or other unresolved questions.

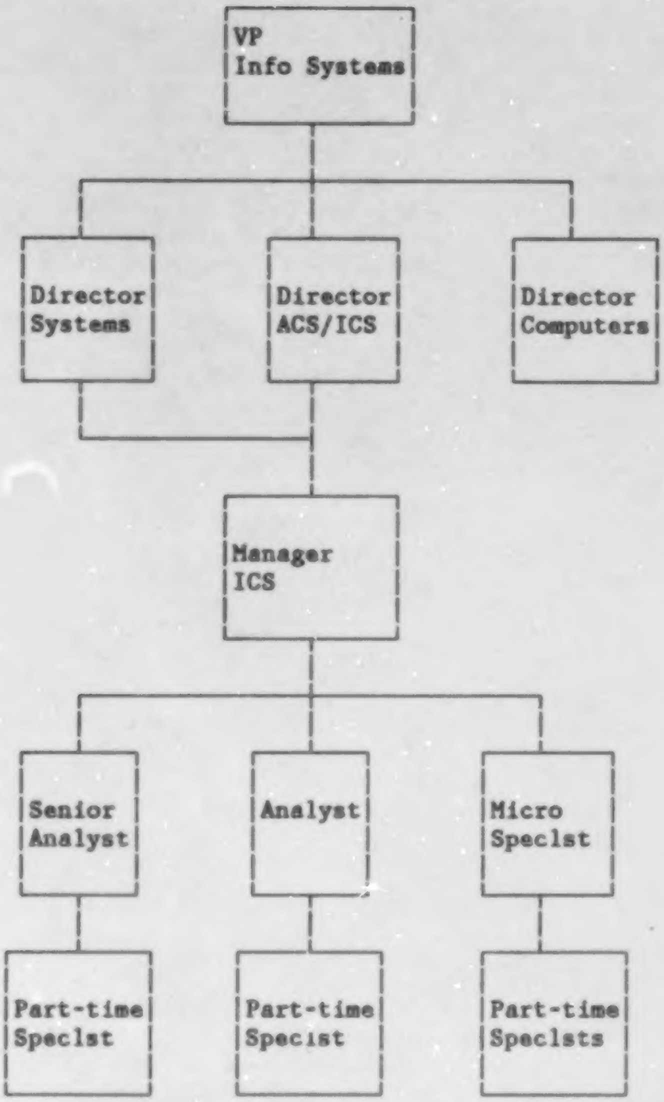
VP
Info Systems
Director
Systems
Director
ACS/ICS
Director
Computers
Manager
ICS
Senior
Analyst
Analyst
Micro
Speclst
Part-time
Speclst
Part-time
Specist
Part-time
Speclsts

Figure 1.

The need for guidelines.

The guidelines presented in this paper resolve two questions: 1) Should the project be serviced by Systems Development or Information Center Services, and 2) If the project is to be serviced by Information Center Services, should it be done on the mainframe or a personal computer. The normal procedure for review of a request for Systems Development is cumbersome due to the multi-campus nature of the University. Administrative and Information Systems offices are distributed among the three campuses: the user may be at the downtown Water Tower campus, the ICS Manager is at the north-side Lake Shore Campus, and the Systems Development office is at the suburban Medical Center campus. The paper request form can easily take more than a week to reach the Systems office for review. Thus it was impractical to have the normal Systems Development review process designate all the projects that were best handled by Information Center Services. What was needed were guidelines that would provide a quick review process for the Systems Development and ICS analysts, both of whom might be approached about what would later be determined to be an ICS project.

A good recommendation in the early contact stage bolsters user confidence and saves planning time and iterations of review and recommendation. An early recommendation also helps avoid jurisdictional disputes between Information Center Services and the team serving the user's large systems needs.

If the guidelines point to the project as one best handled by Information Center Services then the decision must be made as to whether the application will be done on the mainframe or a personal computer. The mainframe used for ICS projects is an IBM 3081D running MVS. As discussed earlier, FOCUS, SAS, SCRIPT, and EASYTRIEVE are the major software tools. The recent development of a three year strategic plan for computing resources, and the upgrade from an IBM 3033U as a consequence of the plan, insures sufficient mainframe resources for projects best done on a mainframe. The current widespread promotion of personal computers for problems of all sizes can cause users to shun the mainframe when if offers a superior solution. Conversely, the guidelines help the user justify a personal computer in a budget request when one is most advantageous.

The guidelines

The guidelines are in the form of matrices with each decision criterion represented by a separate matrix. The set of matrices in Figure 2 determines whether the project is one for Systems Development or Information Center Services; the set of matrices in Figure 3 determines whether an Information Center Services project should be done on the mainframe or a personal computer.

The review progresses sequentially through each matrix in the set. The Figure 2 set of matrices produces three possible results: SD, ICS, or an asterisk. An asterisk means that further criteria must be used. For both sets of matrices the horizontal axis represents one of four categories of potential applications: decision support (DSS), word processing (WP), transaction processing (TP), data base(DB).

Conflicting results are possible but infrequent. They require further discussion and judgement. However, for the Figure 2 matrices the first two criteria, obvious in their results, are usually dominant. Judgement and discussion must also be used to those rare projects that result in no recommendations from the matrices.

Criteria for selecting either the mainframe, an IBM 3081D under MVS, or a microcomputer, are shown in Figure 3.

INFORMATION CENTER or SYSTEMS DEVELOPMENT

		KIND OF APPLICATION			
		DSS	WP	TP	DB
PROJECT SETUP TIME	1-5 DAYS	ICS	ICS	ICS	ICS
	1-2 WEEKS	ICS	ICS	SD	SD
	> 2 WEEKS	ICS	*	SD	SD

Figure 2, Matrix 1.

		KIND OF APPLICATION			
		DSS	WP	TP	DB
SCOPE OF DATA	DEPARTMENT	ICS	ICS	ICS	ICS
	DIVISION	ICS	ICS	SD	SD
	UNIVERSITY	ICS	ICS	SD	SD

Figure 2, Matrix 2.

		KIND OF APPLICATION			
		DSS	WP	TP	DB
SIZE OF DATASET	< 500 RECORDS	ICS	ICS	ICS	ICS
	500-5000	ICS	ICS	*	*
	> 5000	ICS	*	SD	SD

Figure 2, Matrix 3.

		KIND OF APPLICATION			
		DSS	WP	TP	DB
CRITICAL VALUE OF DATASET	< $500	ICS	ICS	ICS	ICS
	$500-5000	ICS	ICS	*	*
	> $5000	ICS	*	SD	SD

Figure 2, Matrix 4.

* Denotes other criteria used.

MICROCOMPUTER or MAINFRAME COMPUTER

		KIND OF APPLICATION			
		DSS	WP	TP	DB
SIZE OF DATASET	< 500 RECORDS	MICRO	MICRO	MICRO	MICRO
	500-5000	*	MICRO	*	*
	> 5000	*(1)	*	MAINFR	MAINFR

(1) Extracted, downloaded files. Matrix 3 used first for datasets of less than 500 records.

Figure 3, Matrix 1.

		KIND OF APPLICATION			
		DSS	WP	TP	DB
SCOPE OF DATA	SINGLE USER	MICRO	MICRO	MICRO	MICRO
	1-4 USERS, ONE LOCATION	MICRO	MICRO	*	*
	> 4 USERS OR MULTI LOC	MICRO(2)	MAINFR	MAINFR	MAINFR

(2) Downloaded files from mainframe.

Figure 3, Matrix 2.

		KIND OF APPLICATION			
		DSS	WP	TP	DB
FREQUENCY OF USE	WEEKLY	*	MAINFR	MAINFR	MAINFR
	SEVERAL TIMES A WEEK	(3)	(3)	(3)	(3)
	SEVERAL TIMES A DAY	(4)	(4)	(4)	(4)
	FREQUENTLY OR REAL TIME	MICRO	MICRO	MICRO	MICRO

(3) Probably mainframe; depends upon availability.
(4) Probably microcomputer; depends upon availability.
* Other criteria used.

Figure 3, Matrix 3.

Section II

In this section we will further describe Loyola's Information Center and look at how the project management matrices are applied to Information Center project requests. Also, we will assess how effective and complete the matrix system is.

Evolution of the Information Center

When the Information Center at Loyola (ICS) was established in 1980, there were no implementation prototypes to follow. The concept of the Information Center and it's companion "end-user computing" have since received a lot of press, but even now, there are many diverse definitions of these phrases. To define our Information Center, we will focus on some general distinctions.

INFORMATION CENTER PROJECT ASSIGNMENT GUIDELINES

All Information Centers are characterized as providing advice and training to create self sufficient users, usually by means of a fourth generation computer language. We will use the following classifications to distinguish types of Information Centers:

1. Type 1 provides advice and training only.

2. Type 2 provides advice, training and either a) Writes programs for users or b) Assists users in gaining access to data owned by the institution.

3. Type 3 provides advice, training, writes programs for users and assists users in gaining access to data owned by the institution.

It is common for an Information Center to evolve through these phases to a Type 3. Through this evolution there is an increase in the complexity of the services the center provides and in the problems it faces. Loyola's Information Center began as a Type 3 - programs and complete systems were written using fourth generation languages and which had access to data owned by the university. To insure that the Information Center did not do projects which should be formally developed by Systems Development, project assignment guidelines were required. Before these were created, we were faced with the following problems:

1. There was no check for redundancy. The Systems Development Department is divided into project teams, as described earlier. The Information Center staff, as generalists dealing with all facets of university computing, lack the familiarity with existing systems to determine if the requested program or report already exists.

2. The Systems Development project team could lose control of programs and data used in their specific areas.

3. Duplicate, decentralized databases were created. Data consistency problems are likely when multiple databases contain the same information.

4. By definition, a completed Information Center program or system is turned over to the user, who then assumes responsibility for data security. Information Center software (mainframe fourth generation languages or micro based packages) do not provide the level of backup, security and recovery that is provided by Systems Development's applications software.

The use of the project assignment guidelines insure that these issues are considered. In addition, the guidelines establish project jurisdiction based on project hours, scope of data, dataset size and the critical value of the data to the university.

Project Evaluation and Assignment Procedures

The Infomation Center encourages users to drop by to discuss project ideas, on a casual basis, with an analyst. The user is given a general idea of what the center does as opposed to what the Systems Development Department does. When the user has formulated a pretty good idea of his or her project resource requirements, the analyst consults the guideline matrices to determine which department should receive the project request. If the matrices point to ICS, then the user fills out a "Request for Information Center Services" form (see Figure 4).

When this form has been completed and returned to the Information Center, the manager and analyst further review the requested project using the guidelines. To illustrate, we will use an actual, and typical, project request. The Student Services Department requested that a file management system be set up to maintain records of the various student organizations - clubs, Black Student Organization, political groups etc.- at Loyola. To use the guidelines matrices, we first had to determine which of the four categories - Decision Support, Wordprocessing, Transaction Processing or Database - the project fell into. In this case, it was the Database category. Use of the matrices yielded the following information:

1. Matrix 1 "Project Setup Time". Result: ICS. The project could be completed in one week (40 project hours) or less.
2. Matrix 2 "Scope of Data". Result: ICS. Although student data is used by many departments, the Student Services Department has equal ownership of the particular fields required for the project. So, the scope of the data can be considered as departmental.
3. Matrix 3 "Size of Dataset". Result: ICS. The total of records maintained by the system will be under 5000.
4. Matrix 4 "Critical Value of Data". Result: ICS. The cost to recreate the data, in the case of loss, will be less than $5000.

The guidelines indicated that this was an ICS project. To complete the review procedure, the ICS Manager signs and sends the Request for ICS Services to the manager of the Systems Development project team that would normally service that user's organizational division. The manager will review the project and issue approval or reject approval. If the project requires access of confidential data, the last page of the service request will be completed and sent to the university administrator who "owns" the data, who will approve or reject access to the data. Once all approvals are issued, ICS schedules a project start date and informs the user.

The guidelines offer further assistance in the matter of where to put the application: on a microcomputer or on the mainframe; see Figure 3. The matrices do not require much interpretation to guide the choice and the matter is usually resolved quickly. Note, though, Matrix 3 should be used first for cases of less than 500 records. And, with the growing use of microcomputers which emulate mainframe workstations, the best of both worlds can be achieved.

The benefits of the guidelines

The above example illustrates how the guidelines are applied. The described project and review typify seventy to eighty percent of projects that ICS reviews. The remaining percentage are not as neatly handled by the guidelines but are resolved by review at the Director level.

The guidelines do not address one important concern. That is, growth of an ICS developed system. For example, ICS develops a microcomputer database system to track employees of an academic department. The user, after attending ICS training, becomes educated in the operation of the microcomputer, significantly enhances the ICS system, and begins to use the microcomputer for additional purposes. The original criteria for scope of data, size of dataset and the critical value of the data now exceed the criteria of an ICS project. The concern is that ICS and the user have created a large system which maintains data that should be administered by Systems Development. Security, backup and recovery procedures are bypassed.

This situation occurs when a user is successful in learning to fully utilize computers. Naturally, ICS promotes this, but cannot predict how successful a given user will be. What is required is that ICS alert the user to his or her responsibilities and provide training in the management of computer resources. It is the responsibility of ICS to make the user aware of the risks of end-user computing and how to avoid those risks.

The assignment guidelines form a set of standards which must be considered for every project. Most projects are covered neatly by the guidelines. Those that are not can be quickly identified as requiring review by the Director of Systems Development or by the Director of ACS/ICS. Since Director level review is only required for a small percentage of projects, less of their time is spent and project approval is expedited.

The guidelines allow application of data processing checks and balances to end user computing. Standards and controls are therefore possible in an area of computing that could otherwise become chaotic.

FIGURE 4

REQUEST FOR ICS SERVICE

I. ORIGINATOR:

Name:

Date:

Department:

Phone:

Location:

II. DESCRIBE PROJECT IN YOUR OWN WORDS. What are your objectives? What are your desired results?

III. BACKGROUND, SUGGESTIONS, PERSONS TO CONTACT OR INFORMATION SOURCES

1. How often do you expect to use this system? (e.g. once, daily, monthly, annually) ____________

2. When do you need to have this project implemented? ____________

3. Who will be primarily responsible for project? ____________

   Position: ____________

   Any past computer contact or experience? ____________

4. Who else will use the system? ____________________

Their position? __________________________________

Any past computer experience or contact? ___________________________

What will he/she be doing ?
(producing reports, entering data, etc.) ___________________________

Who else will use the system? ____________________

Their position? __________________________________

Any past computer experience or contact? ___________________________

What will he/she be doing ?
(producing reports, entering data, etc.) ___________________________

5. What are the principle reasons for initiating this project?
(i.e. lower cost, improved service, government requirements, etc.)

6. Is this an extension to an existing computer system or project?
If so, which one? ____

IV. PROJECT INFORMATION - Leave blank if you cannot complete this category. The ICS analyst will complete it for you.

1. Number and type of reports run per month
____

(Skip question 2 if you will generate reports only from existing files.)

2. Number of files to be maintained: ________

For each file, indicate:

	FILE1	FILE2	FILE3
The number of records, approximately.	____	____	____
The number of pieces of information per record.	____	____	____
The number of records to be added per month.	____	____	____
The number of records to be updated each month.	____	____	____

ADDITIONAL COMMENTS :

SIGNATURE DEPARTMENT HEAD	TITLE	DATE

---

* * * * * * * * * * * * * FOR SYSTEMS USE ONLY * * * * * * * * * * * * * * *

ICS Review for:
1. Cost effectiveness
2. Feasibility

SIGNATURE DATE

APPROVED _____ REJECTED _____
Project No. _____ ____________________________ ___________

Systems Development Manager Review

Approval should be issued based on the project being:
1. Non-redundant with existing systems (no duplication of effort).
2. Feasible within present system capabilities.

SIGNATURE DATE

APPROVED _____ REJECTED _____ ____________________________ ___________

Indicate 'X' to request a meeting with ICS and the User ----> ___________

COMMENTS

Authorization to Read Data Owned by

____

The data fields listed on this page are required by the Information Center Services (ICS) department for use with proposed computer application (ICS PROJECT #________) originated by:

Name ______________________________ Dept. ______________________________

The computer data will be accessed by:

Name(s) ____________________ ____________________ ____________________

Access to the data will be required for a period of: ____________________

The frequency which the data will be accessed will be: __________________

Reports based on the data will be distributed to:

Name(s) ____________________ ____________________ ____________________

Dataset name ______________________________________

Data Fields:

____________________ ____________________ ____________________

____________________ ____________________ ____________________

____________________ ____________________ ____________________

____________________ ____________________ ____________________

____________________ ____________________ ____________________

____________________ ____________________ ____________________

The nature of the application which will use the data is:

____

Your signature below will indicate that the project originator has your consent to have read access to the above data items only , and only for the purposes of this project. Please feel free to call on the Systems Development manager named below or ICS if you have any questions.

Owner's signature __________________________________ Date _____________

Please return this form to:
Name ___________________________ Signature ___________________________

JRS 08/03/83

MANAGING INCREASED DEMANDS FOR COMPUTER RESOURCES

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ABSTRACT

One of the complications which can result from achieving campus-wide computer literacy, is excessive demand for computer resources, particularly in the areas of mainframe overloading, and convenient access to the system.

Effective alternatives to increasing mainframe capacity include the use of microcomputers, multiplexors, port selectors and other techniques. Since computer systems tend to be input/output rather than CPU bound, tradeoffs for various methods of on-line communications are considered as means of improving performance, i.e., accessibility and response time.

Management considerations include educating the user, establishing policies, providing guidelines, control of the resources, and planning for future growth.

As more and more users become skilled in taking advantage of the computer's capabilities, demands on time, space, and accessibility are increasing in seemingly inordinate proportion to the available resources. At the point where these demands exceed the inherent resource limits, overall system performance deteriorates. Probably the most common symptoms of an overloaded system are (1) degradation in response time, (2) the inability to gain access to the mainframe, and (3) inadequate on-line storage capacity.

In short bursts, such deterioration is generally tolerated, but when the situation is chronic, an effective remedy must be sought. The first step in providing an adequate solution, is to diagnose the symptoms in order to determine the source of the problem.

Once the nature and scope of the problem is ascertained, the next step is to consider the options. These may include:

1. Controlling resource usage

2. Educating the users

3. Replacing obsolete hardware and/or software

4. Distributing the load.

Continued improvements require the additional steps of monitoring and planning in order to ensure a smooth operation as well as a means of expanding in an organized manner. Funding future growth is a final, yet, important consideration.

CONTROLLING

Controlling resources, similar to the budgeting process, at first glance appears unpleasant and undesirable, but once the mechanism is in place, emergencies become the exception and order prevails. Quotas may be imposed on CPU time, connect time, disk space, line restrictions, dial-in hour limits, number of tape mounts, prime time usage or any combination which eases the situation. Quotas need not be uniform for all users, but should be consistent across a broad category, such as:

1. students
2. faculty
3. clerical/administrative
4. computer center staff

Any or all of these categories may be further subdivided to accommodate more adequately various user needs, e.g., students majoring in computer science may have greater needs than students in general or data entry personnel may require more time than general management personnel.

Users with exceptional needs should be considered on an individual basis, with adjustments made according to the particular situation. Higher quotas may be granted on a permanent or a temporary basis, but in all instances, the request and approval/disapproval should be written rather than verbal. Written requests and approvals eliminate misunderstandings and serve as a control against resource abuse. Pre-printed forms, routine processing procedures and assignment of the review process to a specific individual or group greatly simplifies this task.

When there is another feasible alternative, such as the use of wordprocessors, these options should be shared with the requestor as part of the approval/disapproval step. Users should be encouraged to be knowledgeable in the use of available resources.

Some examples of the types of controls that might be utilized include:

Hours Limits

Limits may be set on the hours for using dial-in lines by category of user. For example, if certain faculty or administrators must use dial-up lines during the prime time (8 a.m. - 5 p.m. weekdays) because of wiring inadequacies, restricting student use to non-prime time hours might be implemented. This usage can be controlled on-line through log in procedures.

Time Limits

Limits may be imposed on the amount of prime and/or slack time for any category of users. Because of the nature of their schedules, students may require more evening and weekend time, whereas clerical and computer staff may require most of their allocation during the normal work hours, i.e., prime time.

Disk Space

Allocations of disk space should be based on the types of computing tasks to be accomplished and the time frames for performing those tasks. The registrar or alumni/development staff generally require considerably more disk capacity for more extended periods than the majority of other users, with the average faculty and student requiring less respectively. Exceptional requirements are usually easily recognizable, e.g., a faculty conducting research or students completing an honors project relative to computing.

EDUCATING

Another effective means of improving performance can be achieved through user education, although the benefits may appear less dramatic than some of the other alternatives. The first step in educating the users is to explain the situation; resources are limited and dollars expended in providing unlimited computing resources cannot be spent in other areas. The next step is to enlist the users cooperation in conserving resource utilization through constructive and productive application. Educating the user also includes teaching individuals and/or groups in the proper use of hardware and software, the available tools, and related policies and procedures. This education may be accomplished through seminars, newsletters and other publications, integration into classroom sessions, homework assignments or special projects and programs. In addition to improving performance, knowing how to use the available hardware and software, reduces the amount of computer staff time spent in individual consulting sessions for routine problems.

Sometimes policies may be implemented for areas where it is difficult to control the situation through on-line means. In these situations, the emphasis is on cooperation through education rather than restrictive measures and punishment. An example might be in what and how much is printed on any device or on specific devices; slow speed decentralized, versus faster speed, centralized printers.

REPLACING

The replacement of hardware and software should not be overlooked as a means of improving systems performance. Hardware replacements for terminals/printers should be considered, when the particular device:

1. is used infrequently because it is outmoded, nonstandard or difficult to use.
2. requires excessive maintenance, e.g., a value which is comparable to replacement costs.
3. is constrained by slow transmission rates.
4. is more expensive to operate than newer models with advanced features, such as page buffering which reduces the number of I-O's and hence speeds response.

Along with terminal replacements, consider increasing baud rates on existing units, dial-up ports, and modems. Another alternative is to replace multiple slow speed printers with one medium or high speed batch device in each high volume remote area. Other suggestions for hardware replacements are included in the section on distributing the load.

Although it is easier to measure the efficiency and reliability of hardware, replacement or restrictions on the use of certain software should not be overlooked as a means of improving systems performance. Being informed, benchmarking, monitoring and feedback are some of the tools which protect against "resource grabbers", i.e., those software products which literally bring the CPU to its knees or otherwise adversely inhibit performance. Among these products are compilers, operating systems, application tools, such as data query languages, and individual applications or programs. The problems may be manifested differently, but most probably they exist in all areas of academic and administrative computing.

Counter measures include using the right tools for the job, controlling the purchase of software, education in the use of languages and packages, restricting usage by time, equipment and class of user, as well as the implementation of menu-driven products, wherever feasible.

DISTRIBUTING THE LOAD

Load distribution entails several concepts including the utilization of microprocessors, port selectors, multiplexors and other hardware options. Choosing an appropriate option is contingent upon assessment and analysis of the nature and extent of the demands for computer resources by various categories of users, as well as a fundamental knowledge of the alternatives.

Microcomputers

Whether the environment has multiple central processors or a single mainframe, and whether the overall system size is small, medium or large, the use of microcomputers for those tasks which clearly require minimal or no mainframe interaction provides a good payback. Student writing assignments and introductory computer courses such as BASIC programming and graphics can generally be accomplished via micros. These may be stand-alone units or may have mainframe networking for some tasks, such as file transfer to the central processor.

Point-to-Point

In situations where terminals are hard-wired to specific computer ports, the number of terminals cannot exceed the number of ports, i.e., there is a one-to-one relationship of terminals to ports, which limits user access to the system.

Multiplexing

One alternative to point-to-point connections is multiplexing. Multiplexing is transparent to the user and acts like a point-to-point link. Multiplexors provide better utilization of resources by allowing the connection of multiple terminals to a single computer port over a single transmission line, creating a n:1 port to terminal relationship whereby the number of terminal connections exceeds the number of ports on the CPU.

While all multiplexors serve the same purpose, each functions differently. There are advantages and disadvantages for particular situations based on the inherent functionality of the type of multiplexing used. The major types include:

Frequency Division Multiplexors
Time Division Multiplexors
Statistical Time Division Multiplexors
X.25 Multiplexors

Frequency Division Multiplexors (FDM)

In simple terms, frequency division multiplexors are analog devices which require no modems and divide the bandwidth into separate channels such that:

$$\boxed{\frac{\text{Total Line Speed}}{\text{device speed}} = \text{no. of devices}} \qquad \boxed{\frac{1200 \text{ bps}}{300} = 4 \text{ devices}}$$

Using 1200 bps as a line speed, four (4) terminals can operate at 300 bps.

Due to limitations in the number of devices, and the slow transmission speeds, FDM's are considered obsolete for most needs, although they are still used for low volume transmissions in some asynchronous environments.

BEST COPY AVAILABLE

Time Division Multiplexing (TDM)

Time Division Mutliplexor operates digitally, requires modems, and employs a time slot system, in which each connected device is allocated an equal amount of time to transmit/receive based upon:

$$\boxed{\frac{\text{line speed}}{\text{device speed}} = \begin{array}{c}\text{no. of devices}\\ \text{(time slots)}\end{array}} \qquad \boxed{\frac{\text{9600 bps}}{\text{2400 bps}} = \text{4 time slots}}$$

TDM is more flexible than FDM, but still has limitations. The major disadvantages are that bandwidth is allocated to each terminal connected regardless of whether there is any transmission and because transmission is continuous, a TDM cannot retransmit on-error.

Other TDM characteristics which may be an advantage in some applications include:

1. Time Division Multiplexing is not protocol sensitive.
2. Terminals transmit without invitation from the host; without polling and acknowledgements.
3. TDM allows for buffering a complete character asynchronously so that start/stop bits are not transmitted with data, resulting in more room on the line for information.

Statistical Multiplexors

Statistical multiplexing can be considered an intelligent form of time division multiplexing; one in which some risk or probability is involved. The probability is based upon the premise that the terminals connected to a multiplexor operate simultaneously only about twenty percent of the time. Statistical multiplexing takes advantage of this premise, allowing the sum of the individual transmission speeds to exceed the line speed, by dynamic allocation of bandwidth as terminal transmission demands; there are no idle time slots. As a hedge against the risk of transmission demand exceeding capacity, statistical multiplexors have buffers for temporary storage.

As with TDM's, statistical multiplexors have strengths and weaknesses. The major weakness is the possibility of up to 100ms delays in either direction, which is a tradeoff resulting from the inherent benefits. In addition to the ability to connect more devices, other strengths include:

1. The ability to retransmit automatically when errors are detected by the receiving mux.
2. The ability to interact with various protocols from a mix of terminals.

3. The ability to transmit more data than other multiplexing techniques; four times as much asynchronously and almost twice as much synchonously.

4. Data compression which allows more information to be transmitted at a time and increases through it by another twenty to thirty percent.

One very important advantage to multiplexing is that the costs to lease lines can be reduced. By requiring less lines, substantial savings can be realized, especially in long distance and external networking situations.

X.25 Multiplexing

Another means of providing flexibility is through X.25 pads which have more features and functions than statistical multiplexing. The X.25 option not only provides a means of communication in the local environment, but also serves as a gateway to public networks. X.25 pads which meet X.25 1980 CCITT standards can communicate world-wide, because they have HDLC, Level 3 protocol compatability, while statistical multiplexors are limited to HDLC, Level 2 compatability. The significance of this is that Level 3 X.25 compatability will allow communications between mixed vendors products. Statistical muxes generally communicate only within a family of products from the same vendor. The X.25 option provides for future growth, without the cost of replacement.

Port Selectors

Port selectors can maximize the use of equipment, balance loads, reduce costs and eliminate communications interfacing problems. Port selectors can also be used to control access by time-of-day, to particular equipment or software, from certain locations, or various combinations of these.

Port selectors provide a terminal-to-port relationship which is many-to-one (m:1) in a single CPU environment or m:n in a multiprocessor environment. In the single CPU environment the major benefits of a port selector is derived from replacing point-to-point connections which inhibit the number and location of terminals and render ports unavailable when users are not logged-on. Port selectors allow flexibility in matching the available resources to the demand patterns of the users, reducing the overall costs to provide a particular level of service and convenience.

Even greater benefits can be realized in multiprocessor environments, especially in academic instituitions because of the manner in which access is required by the various groups. Administrators generally require prime time, while students and faculty may do more computing at night and on weekends, with prime time needs interspersed between class schedules.

Most users require intermittent rather than continuous hook-up to the mainframe. Academic users typically log-in three times a day for sessions of twenty minutes duration with an average daily connection time totalling just over one hour. Administrative users, overall, log-in on the average of six times per day for approximately fifty minutes per session or five hours of daily connection to the mainframe. In considering these figures, be aware that programmers, cashiers, registrars, and other personnel log-in on an all day basis, while upper management, department heads, and others have needs which are met with an average of twenty or thirty minutes of connect time per day.

Moreover, the administrative processing crunches occur at different times in the semester than similar peaks for the academic community. For students, computing needs start slowly with a gradual increase which peaks slighlty around mid-semester and then increases dramatically until the end of the term. Administrators and faculty, on the other hand, have heavy uses at the beginning and end of the term, congruent with registration, drop/add and grading cycles. Since there are two different peak periods, it is possible to meet the needs without providing maximum capability for each central processing unit; a method known as "peak shaving". This is an important consideration in planning for additional equipment.

Administrative and faculty computer users want to have terminals, printers and other input/output devices in locations convenient to their work place, i.e., on their desks, whereas students want their resources located where they congregate to study; in the residence areas or in other easily accessible buildings with continuous availability. There is nothing wrong with these desires. Convenient use of resources is often a necessity rather than a luxury. However, it is neither reasonable nor necessary to provide a computer port for each potential user. Nor is it reasonable to rely solely on microcomputers because the mainframe is overloaded and ports are scarce.

Other Options

Local area networking is an emerging technology which provides another alternative to meeting users' growing needs for high speed flexibile, convenient communication between a plethora of devices, dispersed throughout offices, buildings, and locations. LAN and other devices are being used alone and in conjunction with multiplexors and port selectors, to increase performance by reducing input/output (I-O) overhead on the central processor. The options are many and varied--more than time and space allow for inclusion at this juncture.

MONITORING

In order to provide ongoing continuous service in a cost-effective manner, it is necessary to monitor acitvity within the environment. Know the user. Know what goes on in the system. Guard against unauthorized use. Charge competitive rates for external users. Inform all users of the cost of computing in dollars and cents, even though there may be no income/expense involved in any real sense.

PLANNING

Change is inevitable. Change is more readily accepted when the tranisition is planned. Good planning is contingent upon being informed. Look at new products, new solutions, new problems with the freshness of a first-time approach.

Think big. Act small, i.e., implement in phases. It is better to have several small successes on the way to the bigger goal than to have one enormous and possible ultimate failure.

Innovate! Use your imagination. If plans are constrained by monetary resources, look for alternatives in the way of grants, alumni or corporate donations, discounts or whatever.

FUNDING

Options may be increase by thinking modularly. By dividing your plan into components, you may be able to garner funds from several sources; small or large. Ascertain the level of interest in potential donors and incorporate those interests into the request wherever possible. For example, if an alumnus perceives microcomputers as important to the mission of the institution, funding may be realized for a micro lab, or adding capability to residence areas, classrooms, terminal cluster areas, or offices, if you have a plan available.

Be ready----have that plan---just in case someone asks, "What would you do with $$$$$$?"

CONCLUSION

As the level of computer literacy rises and new demands are placed on existing computer resources, the institution's administrators must respond in a manner which not only provides an adequate level of computing capability, but with one which does so without adversely affecting other programs and institutional needs.

The options are many, but with cooperation, understanding, planning and commitment, seemingly endlesss resource requirements can be fulfilled for the present and extending into the foreseeable future.

IS INFORMATION RESOURCE MANAGEMENT PRACTICAL IN A SMALL COLLEGE SETTING?

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ABSTRACT

This presentation will describe one model of elevating what was once a computer center to the level of vice president in an institution which is totally committed to computing in all phases of academic and administrative life. The board of trustees proposals and discussions before the various committees will be reviewed but the focus will be on the resultant organization which has its own board committee overseeing the Vice President for Information Services. This discussion should be particularly interesting for small to middle size institutions who are contemplating adopting what is often described as information resource management and bringing together under one umbrella a variety of information services such as: computer, data communications, tele-communications, audio-visual services, voice communications, office automation and microcomputer support throughout the campus.

Many authors agree that for reasons of efficiency and effectiveness various services that were heretofore considered separate and in some cases distinct should be brought under the umbrella of information services. While the list of services varies by author, there is general agreement that at the very least these services should include data processing, office automation, and data and voice communication. In an academic setting, academic as well as administrative computing, the library and publications are often included. McFarlan and McKenney suggest that the key reasons for merging the islands of IS technology which they identify as data processing, telecommunication and office automation are:

"1. Decisions in each area now involve large amounts of money and complex technical/cost evaluations. Similar staff backgrounds are needed to do the appropriate analysis in each case.

2. Great similarity exists in the type of project management skills and staff needed to implement applications of these technologies.

3. Many systems require combining these technologies into integrated networks to handle computing, telecommunications, and office automation in an integrated way."[1]

As Nolan has pointed out in his stages growth[2] for the typical computer center and it's applications development, there is a cycle through which most such organizations pass through on their way to maturity. This is also the case with the migration from a traditional computer center organization to one which has adopted Information Resource Management. This is certainly the case for Bentley College since the person managing the center has had a different span of control over the years and the position has reported to various Vice Presidents in the organization. When the center was first established in 1970, the Director reported to the Academic Vice President. Over the next ten years various computers were installed and there was a succession of changes in reporting responsibility wherein the Director of the Computer Center reported to the Vice President for Business and Finance & Finance and later to the President directly before reverting back to the Vice President of Business and Finance.

During that ten year period, the responsibility for academic computing also vacillated and initially this function reported to the Director of the Computer Center but in an attempt to bring it under the direct control of the academic administrators the reporting responsibility of the Manager of Academic Computer User Services was transferred to the Dean of the Undergraduate College in 1981. This was still the situation when the College began to think seriously about combining all of the Information Services functions under a Vice President. The other functions which have been suggested as belonging under the umbrella of Information Resource Management were also reporting to individuals other than the Director of the Computer Center. While the responsibility for data communications came under the Director, telephone communications reported to the Vice President for Student Affairs, word processing reported to the Director of Academic Administrative Services, the Library Director reported to the Academic Vice President and the responsibility for video projection and audio/visual services reported to the Library Director.

The organization chart in Attachment A depicts the status of the reporting responsibilities in 1982 when various board committees and the administration began discussing the feasibility and possibility that some or all of these functions would report to one individual that would carry a Vice Presidential title. The person occupying this position would sit on the President's cabinet thereby elevating the role of Information Services to the highest reaches of the organization. It is clear from a brief review of this chart that it was really no one's responsibility to oversee all of the Information Services functions unless the President chose to do so himself.

There were a number of situations which provided the impetus for seeking to have better coordination of the various aspects of information services not the least of which were several disjointed attempts at selecting hardware for administrative as well as academic computing. After six or seven years of sharing a large DEC10 system with the academic community, the administrative people decided to acquire their own system in the form of a Burroughs B6800 with the goal of splitting academic and administrative computing. Subsequent to this decision in 1979, the academic people sought to make a decision to upgrade the DEC10 system to a multi-processor time-sharing system and made several recommendations before settling on the acquisition of three Prime computers. While this was being determined, the administrative staff had not made any progress with the Burroughs system. Thus, they decided to acquire a package(AIMS) that would run on the Prime system since there was at least some conventional wisdom which suggested that maintenance of one operating system with a meager staff would be simpler to maintaining multiple systems.

While these evaluations were proceeding, various consultants and task forces were established in both academic and administrative computing and an advisory committee which consisted of five members of the Board of Trustees and five external members was appointed to review the proposals of the various campus committees for hardware and software upgrades. This was an Ad Hoc committee chaired by a member of the Board which made recommendations to the President and the Board of Trustees as regards directions which should be pursued.

Throughout the period of 1982 and 1983 a few members of the Board of Trustees were making suggestions that a Vice Presidential position be created in order to provide better coordination of the information service functions as well as provide a forum for what was becoming an increasing important aspect of the College's life. By this time, there was a proliferation of some 360 terminals on campus that were attached to 3 Prime 850 computers, the College had acquired 100 APPLE computers, as well as an IBM System 34 and a PDP11. The academic program had progressed to the point where a substantial number of courses were utilizing the computer and the administrative Systems group had installed a number of the AIMS modules over the summer and fall of 1982.

In recognition of the fact that a problem existed, a revised committee structure was developed in December of 1982 which created a steering committee, as well as an academic and administrative planning committee to funnel requests for service to the Director, who by this time reported to the Vice President for Business and Finance. This Vice President was also chair of the Steering Committee. The chair of the Academic Committee was the Dean and the chair of the Administration Committee was the Director of Academic-Administrative Services.

Prior to discussing the reorganization, it is significant to note that an important procedure was formalized prior to these discussions and this was the establishment of the Information Resource Reserve. This was and is a separate budget for capital acquisition of hardware and software whether it related to computers, network equipment, data communications, video projection, Library systems, word processing, microcomputers, office automation or any other relevant components. This not only reflected the commitment that the College had to upgrade the technology on campus but also was an indication of the need for coordination of acquisition of hardware and software. This fund was established as a rolling fund and monies not expended in one year are merely transferred to the next budget year. Requests for expenditures against this fund are fed through the planning and the steering committees and proposals are made for the establishment of the budget to the Board of Trustees Business and Finance Committee on a yearly basis.

In the spring of 1983, the Director of the Center left and this author was appointed interim Director for what was anticipated to be a short period of time. This was seen as a propitious time to make the formal recommendation from the steering committee to the President and the Board of Trustees to combine the various information service's functions under a new Vice President. It was anticipated that there would be political hassles and that we would not be able to co-op all of the services initially but that the establishment of a Vice President would at least permit the centralization of some of these services. The hope was that other services would be transferred under the Division's aegis at some later time.

As it turned out, the establishment of the Information Services Resource Reserve provided a catalyst for bringing people together because we had to agree on a recommendation to spend money and such was the case with telephone communications. At that time the College had signed a preliminary contract to install a new telephone system. As interim Director, I formed a Campus Communications Committee to study this matter even though the operating budget for this department was not under my control. The net result of these discussions were that prior to the formal establishment of a new division under the Vice President we canceled the telephone contract, and issued a proposal for the establishment of a broadband network in the new Graduate Center building. This was clearly a preliminary indication that the College was beginning to think Information Resource Management and this was closely followed by Board approval of the establishment of the Division of Information Services with the resultant organization depicted in Attachment B. This chart resolved many of the disjointed reporting responsibilities that existed previously.

The responsibilities of this new position were defined in the by-laws of the College as follows:

> The Vice President for Information Services is the chief officer of the College responsible for the planning, development and provision of information services and related facilities to the College. Specifically, he shall be responsible for the planning, development and implementation of management, information and communication systems and facilities including, but not limited to, computer hardware and software.

The previous definition is in consort with McFarlan and McKenney's view of this function where they identify the proper role of the IS chief executive officer as:

"1. Maintaining board relationships personally...

2. Ensuring that strategy-formulating processes are adequately evolved and that appropriate detailed action programs are developed...

3. Paying close attention to salary, personnel practices, and thus to employee quality of life issues...

4. Giving high priority to...security...

5. Making certain that there is an appropriate management balance between the marketing, manufacturing, and control parts of the business...

6. Developing an IS esprit... Senior IS managers must develop team spirit and lead their organizations with enthusiasm into new ventures..." [3]

As had been expected, two key areas were not immediately brought under the wing of the Vice Presidential position and that was the Director of the Library and the Director of Telephone

Communication. As time has elapsed the voice communication has indeed been transferred effective in the summer of 1984 and the new Director of the Library is working more closely with the Vice President of Information Services even though his primary reporting responsibility is still to the Vice President of Academic Affairs. However, as regards proposals for expansion of systems or injecting video on the cable tv plant or other such technological advances, monies for consulting, acquisition of hardware and/or software must be passed through the Information Services Resources Reserve thereby creating a system of checks and balances that seems to be working well at this juncture.

The approval process was not in and of itself complicated or lengthy since it had been in a discussion stage for almost two years but there was considerable discussion about which Board committee the new Vice President should report to. There were some who felt that it should be Business and Finance and others felt that it would be Academic Affairs. The decision was made that proposals would be brought to both of these committees until such time as the Board had an opportunity to review whether or not to establish an Information Services Standing Committee of the Board.

While there was consensus among the members of the President's cabinet regarding the establishment of the new position, there was some concern on the part of the Deans that this was elevating the role of computers unnecessarily to the highest level of the organization. There was also some concern on the part of the Dean of the Undergraduate College to whom Academic Computer User Services reported that the service provided to his organization would diminish or take a back seat to administrative computing. There was undoubtedly good reason for these concerns but subsequent occurrences have eliminated this resistance. Currently, there is little in the way of complaining that this is not an effective method of delivering service to the institution as a whole and the academic community in particular. One particular area that has remained a point of contention was the practice established in 1982 of having User Analysts who were responsible for the decentralized production system within the Administrative computing area who report to their individual Vice Presidents. This practice has continued but the responsibilities of these individuals have been redefined to being coordinator's of computer services. Their role is to manage the operational aspects of the system after implementation rather than serving as systems designers or analysts who are providing direction for the project teams in the Administrative Systems area.

It should be noted that throughout the evaluation period of the proposal to establish a new division and the subsequent discussion about the establishment of a Board committee, members of the Board who were on the previous advisory committee as well as other computer activists on the Board played a major role in selling the idea to the Board at large as well as the President.

Their primary argument was that planning documents, presidential addresses and budget allocations all suggested the importance of computing to the accomplishment of the College's mission and, thus, this was viewed as a desirable change in the organizational structure of the College.

After a six month search for the first Vice President of Information Services, it was decided in December of 1983 that the interim Director would be appointed Vice President. This began the reorganization of the Computer Center department into a division and the hiring of new department heads and getting the new Vice President integrated into the President's cabinet and working directly with the Board of Trustees. At the meeting of the Board of Trustees in the Spring and Summer of 1984, proposals were made to the Executive Committee of the Board to establish the Standing Committee which would have as it's charge to:

a. Review the Information Services and faculties plans,
b. Review the status of the operations, and
c. Make recommendations regarding the Information Services Resource Reserve. The Committee shall report it's findings and recommendations to the Board of Trustees or the Executive Committee.

Since it was anticipated that there would be some objection to this proposal, a list of advantages and disadvantages was provided for discussion at the Summer meeting. As anticipated this proposal was remanded to the administration for further study and was re-introduced at the Fall meeting and passed by the Board. This allowed us time to meet with potential members of the Board who would serve on the committee and work out the language in order to make it acceptable to the Board at large. Even with this careful selection of a few words, there was still some concern at the final Board meeting of whether the Library did indeed come under the area of responsibility of the Information Services Division. There was a suggestion that the word Information be replaced by Computers since the Library reported to another Vice President. After some discussion of what we were trying to accomplish, the opposition which happened to be from an Academic person on the Board was quieted and we proceeded with the proposal as presented.

The result of this and other actions was that the Vice President for Information Services is the chair of the Steering Committee which now consists of the five Vice Presidents as well as the Chairman of the Academic Computer User Planning Committee and the Administrative Systems Planning Committee chair. The recommendations are passed to the President and the new Board Committee for review and submission to the Executive Committee of the Board and finally to the Board of Trustees. It provides each of the five Vice Presidents with the opportunity to have input to any major decision involving capital resources. Further, any proposal which requires substantial operating funds is discussed in the planning committees and the Vice President for Information

Services also appears before the Academic Affairs and Business and Finance committees of the Board when necessary to explain items which may seem crucial to their area of concern.

From my perspective, the reason that the proposal to establish this new Vice Presidency, as well as the standing committee of the Board,was approved was that there was a general recognition throughout the campus of the importance of Information Services to the future of the College. This was not a mere case of incidental use of computers but a total commitment on the part of the administration as well as faculty to integrate the use of the computer into the very fiber of the institution's inner workings. Presently, approximately one-third of all courses at the College require the use of the computer and we expect this to rise to 50 per cent within the next twelve to eighteen months.

The College is totally commited to excellence in academic computing as evidenced by the following Academic Computing Goals:

1. All Bentley College Bachelor of Science and Master degree candidates will be computer literate.
2. The Computer Information Systems Department will offer programs in information systems and computer science that are nationally recognized for the expertise of their graduates.
3. Computer applications will be integrated across the curriculum in appropriate disciplines and courses so that individuals in majors from departments other than CIS will be at the forefront of computer applications in their fields and will be sought by employers for this characteristic.
4. The college will offer credit and non-credit computer programs as appropriate for such audiences as executives, high school teachers, children, small business people and others seeking a level of computer knowledge.
5. All Bentley faculty will be computer literate and able to employ the computer in their courses, where appropriate, within four years.
6. Relevant faculty research will be supported on campus or through time-sharing off campus.
7. The college will support a computing utility that includes mainframes as well as various microcomputers with stand-alone and on-line mainframe access capability.
8. The college will provide for the sale of microcomputers to faculty, staff, and students.

In addition,

1. we have begun developing a campus network system which by the end of this year will touch every academic building as well as begin to encroach on the dorm clusters,
2. we are conducting a pilot test of 110 Freshmen who have

been assigned portable microcomputers,

3. we are proceeding to evaluate the results of that experiment with the view towards having every Freshman own their own personal portable microcomputer in the very near future

4. we are committed to making a computer available to every faculty member doing research or teaching a course that utilizes the computer. As of this date, approximately one-half of the faculty have been supplied with such a unit,

5. we have over two hundred microcomputers and terminals in the Labs,

6. we have in excess of one hundred terminals and microcomputers in the hands of administrators which are tied into an integrated data base for the support of the College's administrative functions,

7. we have assembled a full-time faculty of 28 professors in the Computer Information Systems department to teach service and major courses, and

8. as a result of in-house training agressive recruiting 127 of the 186 full-time faculty are computer literate.

With a commitment of this type it seems critical that a resource and a service which has such an impact on virtually all aspects of the College community should be elevated to a position in the organization where it can have a direct voice in strategic planning, policy making and discussions of curriculum design of new programs as well as revisions to existing programs in order that there may be input at the earliest opportunity. This prevents the sheltering of this person and organization under the wing of a specific Vice President who might have a specific interest and not represent the best interests of the institution as a whole. Most of the articles and the literature on this subject seem to support this point since they represent the position of advocacy and they seem to uniformly call for a direct reporting relationship to the President on an equal basis with other Vice Presidents in order not to minimize the impact or to subjugate this vital area to another operational division of the institution or corporation.

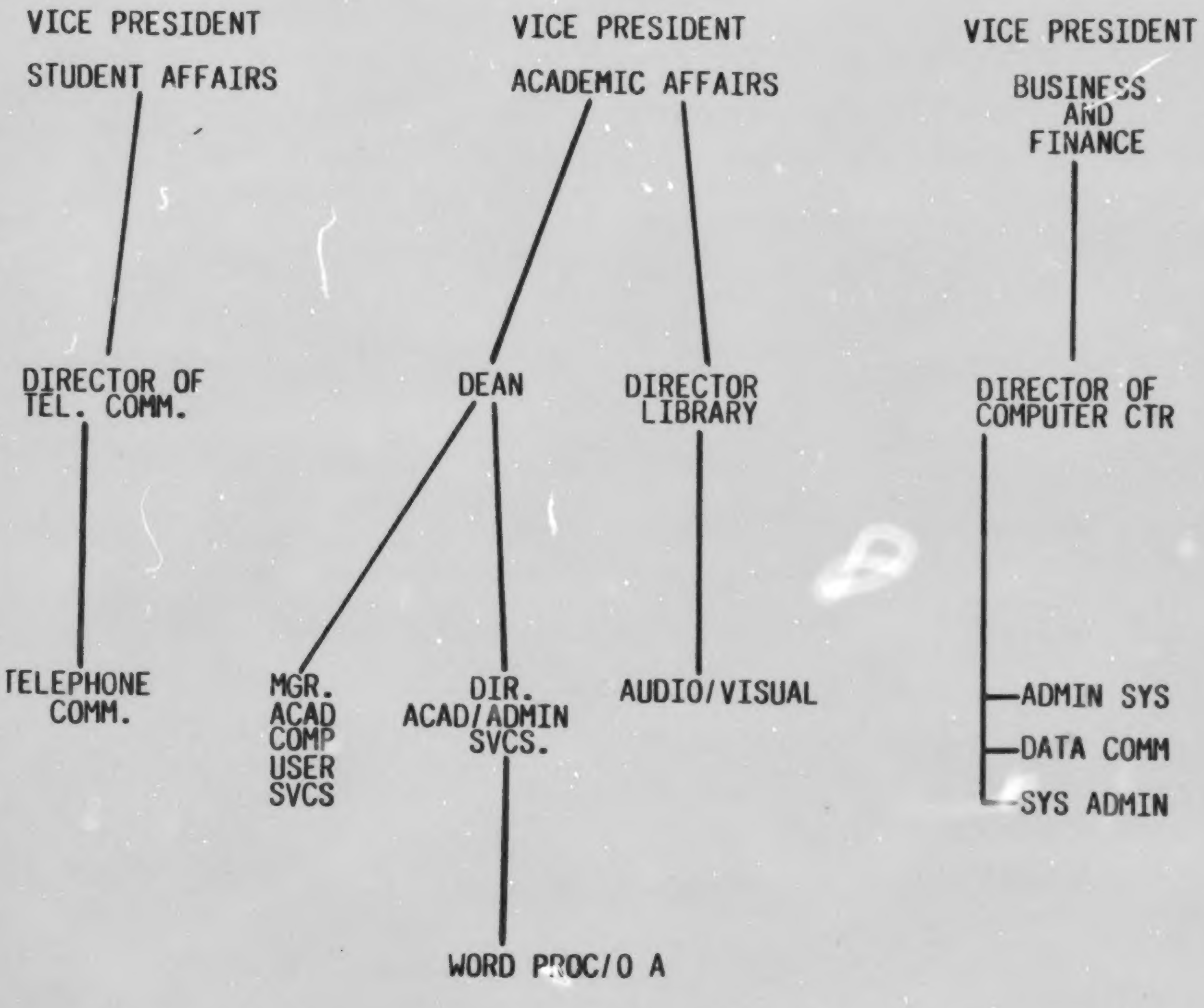
[1] F. Warren McFarlan and James L. McKenney, Corporate Information Systems Management The Issues Facing Senior Management (Illinois: Richard Irwin, 1983) p. 34.

[2] Richard L. Nolan, Managing the Data Resource Function (St. Paul: West, 1982)

[3] McFarlan, op. cit., pp. 197-8

INFORMATION SERVICES

REPORTING RESPONSIBILITIES
1981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ACADEMIC AFFAIRS
VICE PRESIDENT
BUSINESS AND FINANCE
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DIRECTOR LIBRARY
DIRECTOR OF COMPUTER CTR
TELEPHONE COMM.
MGR. ACAD COMP USER SVCS
DIR. ACAD/ADMIN SVCS.
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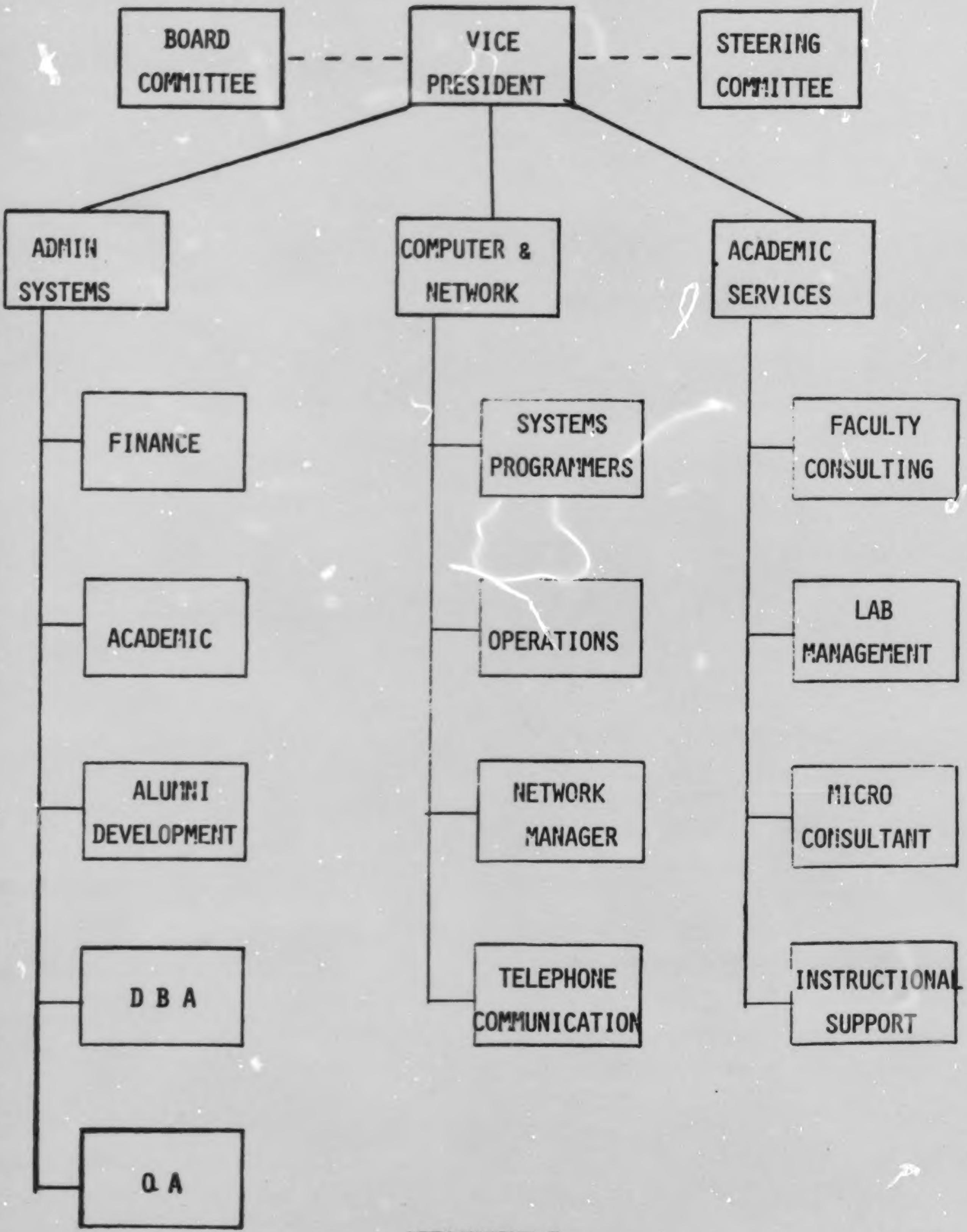
ATTACHMENT A

INFORMATION SERVICES 1984


BOARD COMMITTEE
VICE PRESIDENT
STEERING COMMITTEE
ADMIN SYSTEMS
COMPUTER & NETWORK
ACADEMIC SERVICES
FINANCE
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ALUMNI DEVELOPMENT
D B A
Q A
SYSTEMS PROGRAMMERS
OPERATIONS
NETWORK MANAGER
TELEPHONE COMMUNICATION
FACULTY CONSULTING
LAB MANAGEMENT
MICRO CONSULTANT
INSTRUCTIONAL SUPPORT

ATTACHMENT B

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THE CARE AND FEEDING OF USERS: A KEY TO EFFECTIVE INFORMATION MANAGEMENT

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Over the last few decades there has been a shift from an industrially based to an information based society. The impact of this shift on users and data processing personnel is massive; we are coping with information overload, threat of job loss, dissatisfaction with traditional DP practices, and illiteracy, not only technically, but in basic skills as well. What users want, and are willing to pay for, is the ability to locate, manipulate and analyze the information they need.

DP personnel must become "information managers" who are willing to become involved with users and user businesses. Experts have noted that it is the quality of user relations that will "make or break" the DP departments of the 80's.

But what elements are necessary for effective user relations to exist? The answer is not simple. This paper will discuss several important strategies to this end, including how DP personnel can discover who the users of the DP services are (and should be), several appropriate methods of user/DP involvement and how they can be implemented, and other key elements that are necessary for effective user relations and services to exist.

THE CARE AND FEEDING OF USERS: A KEY TO EFFECTIVE INFORMATION MANAGEMENT

There was a time when data processing was esoteric and clouded in mystique. Computers were huge and difficult to utilize. Users knew little about them, and the technical cloak was a source of power for data processing professionals. In the 1980's, however, the DP professional faces a user community that is less intimidated by computer technology. Synnott and Gruber, in their book Information Resource Management: Opportunities and Strategies for the 1980's, have suggested that more knowledgeable and involved users in the 1980's will either cause an increase or a loss of power for the DP function depending on the effectiveness of user relations.

What elements are necessary for "effective user relations" to exist? The answer is not simple. The shift from uninformed to informed user is, perhaps, an outgrowth of our transition over the last few decades from an industrial to an information society. In 1950, 17% of the work force was employed in information jobs. Today, over 60% of the work force is in jobs that work with information. Between 1970 and 1979, of the 20 million new jobs created, 90% were in information, knowledge or related activities.

In his book Megatrends, John Naisbitt suggests that the five most important things to remember about the shift from an industrial to an information society are:

1) The information society is an economic reality, not an intellectual abstraction. In New York City alone, 40,000 manufacturing jobs were lost between 1977 and 1980. Today, more than half of New York's gross city product is generated by people who work with information. Legal services have now replaced apparel, as New York City's leading export.

2) Innovations in communications and computer technology will accelerate the pace of change by collapsing the information float. Communication is a key to the information age. Communication requires a sender, a receiver, and a channel. Faster communication brings sender and receiver closer together by decreasing the time information spends (or "floats") in the channel. Faster communication thus collapses the information float.

3) New information technologies will at first be applied to old industrial tasks, then, gradually, give birth to new activities, processes, products. Naisbitt notes that technological development takes place in 3 stages: first, the new technology follows the line of least resistance; second, the technology is used to improve previous technologies; and finally, new directions or uses are discovered that grow out of the technology itself. We have moved into the second stage of development via microprocessors. It may be sometime though, before we get to the third stage where we will create things suggested by the microprocessor itself - inventions or applications that are as yet unimagined.

4) In this literacy-intensive society, when we need basic reading and writing skills more than ever before, our educational system is turning out an increasingly inferior product. A 1980 report from the US Dept. of Education and the National Science Foundation stated that most Americans are moving toward "virtual scientific and technological illiteracy". The Carnegie Council of Policy Studies in Higher Education recently reported that "because of deficits in our public school system, about one-third of our youth are ill-educated, ill-employed, and ill-equipped to make their way in American Society". Naisbitt notes that the generation graduating from High School today is the first generation in American history to graduate less skilled than its parents.

5) The technology of the new information age is not absolute. It will succeed or fail according to the principle of "high tech/high touch". What happens is that whenever new technology is introduced into society, there must be a counterbalancing human response - or the technology is rejected.

TECHNOLOGY AND THE INFORMATION SOCIETY

Naisbitt's points regarding the shift from industrial to information age provide insight into what users and data processing people are coping with and will be coping with in the 1980's. Information is an economic entity because it costs something to produce and because people (users) are willing to pay for it. What is valuable is whatever people are willing to pay for. The interesting thing about the information society is that the economy is based on a resource that is not only renewable, but is self-generating. Running out of it isn't a problem. Drowning in it is.

A technological tool which has proved to be effective in coping with massive amounts of information is the computer. However, computer technology is to the information age what mechanization was to the industrial revolution: a threat to the "laborers" or operational staff. It is a threat because it incorporates functions previously performed by workers.

Executives are frustrated with computer technology, as well. Where operational staff are leery of microprocessors, executives in the business community have begun to embrace them. Some executives are learning to program computers themselves because it takes too long to wait for the computer department. In addition to wanting information right away, some business people complain they can't communicate exactly what they want to the DP staff, who may spend weeks on a program only to have it turn out wrong.

What users want in this new information society is the ability to locate the information they need. They want a medium to convert information to knowledge. Supply is no longer a problem. Users are overwhelmed with information. What is valuable is a means to select the information that is needed to get the job done.

Unquestionably, it is technology that will help us to manage the information society. But technology can help manage the society only to the extent that its members are skilled in using it...and as we move into a more literacy intensive society (by one estimate, 75% of all jobs by 1985 will involve computers in some way), our schools are giving us an increasingly inferior product. Without basic skills, computer illiteracy is a foregone conclusion.

So users, and DP personnel, are coping with an information overload; real or imagined threat of job loss; dissatisfaction with DP departments; and illiteracy not only technologically, but in basic skills as well.

THE KEY TO EFFECTIVE USER RELATIONS

Perhaps the key element of effective user relations can be found in Naisbitt's fifth point: "technology will succeed or fail according to the principle of high tech/high touch". Whenever an institution introduces new technology to employees or customers, they should build in a "high touch", or human, component. If they don't, people will try to create their own, or reject the new technology. According to Synnott and Gruber, "attitude, sensitivity, and good communication rather than technological competence are what impress users about DP personnel". Perhaps part of the answer to effective user relations lies in a better understanding between data processing people and users of each others business problems and opportunities.

SPECIFIC STRATEGIES TO ACHIEVE EFFECTIVE USER RELATIONS

What strategies will integrate information technology and user businesses? What strategies will give us that high tech/high touch component? First, it is important to determine who we (DP) serve and how well we are doing, both in service and in responsiveness to the needs of the organization.

The User Inventory

Users can range from the chief executive officer to an assistant manager to a junior clerk. Often, DP professionals spend most of their time serving junior-level people, neglecting the needs of top management. An inventory of users provides an important guide for assessing just who is being served in the organization. Synnott and Gruber suggest that a user inventory include such information as:

- Current level of automation relative to state of best business practices.
- Competence of user staff in utilizing information services; evaluation of key people in a user division.
- Attitudes toward future systems opportunities; degree of systems planning performed in the user division.
- User satisfaction with current DP services.
- Actual quality of services, as defined by the data processing department (which may vary significantly from user perception).

Synnott and Gruber also note that inventories of users frequently provide such important information for DP management as:

> The users who contribute most to institutional profits are receiving little from the DP function and/or Users who contribute little to institutional performance may be consuming the bulk of the DP budget.
>
> Users who are receiving high-quality services may be unaware of their good fortune and may be dissatisfied with DP performance (a perception control problem) and/or DP may be delivering poor service to important users who may not (yet) be aware of this weak performance.

User Involvement

A second set of strategies address the area of user/DP involvement. Data processing personnel need to understand the user's business needs; user managers need to understand more about data processing and systems work. Learning more about each other requires more involvement in each other's business.

Specific strategies to involve users in information management as suggested by Synnott and Gruber include:

1) Foot in the door. This is a strategy whereby DP professionals provide a simple, low cost, rapid response to users in order to demonstrate the costs and benefits of the computer technology. For instance, DP personnel might provide a quick report from a query system or report generator that mirrors a user's manual process, or might use a graphics package to provide a graphic representation of a complicated table.

2) Joint systems development. This strategy involves users in the planning, development, and implementation of their system. This assures success via ownership of the system. However, DP personnel must not be "reaction machines". Joint development gives the user an opportunity to learn about computer technology, and it gives the technician an opportunity to learn about the user's business, his problems, and his concerns.

3) Utilization of Information Resource Product Managers. Under this arrangement, an IRPM is appointed to serve as the user's information processing manager. The manager is given computing resources (could include hardware, computer time, and/or financial resources), a programmer/analyst and whatever else is needed for support of the user's information resource needs. The product manager retains ties with the DP department, and also reports to the user department head. Shared management of dedicated information resources gives users greater control without their having to become data processing experts.

User Service

The third set of strategies for improving user relations involves improving service to users. To serve is to empower or aid. User services is a function which aids users in the utilization and understanding of computer related technology. User service can provide the high touch component in a high tech environment.

We live in an imperfect world. Good performance may be unrecognized and unrewarded. Poor performance may also not be recognized. A key to effective user relations and good user service is adequate Perception Management. Perception management is the process of reconciling user perception of DP performance relative to the actual service provided. Performance standards and objectives should be identified and the total performance picture communicated.

User Service Contracts are also a useful tool for creating proper perception of DP service levels. User service contracts are agreements with users on DP performance objectives and measurement and reporting of actual performance compared with objectives.

A simple strategy for improving user satisfaction is the establishment of a Customer Service Center, or "Help Desk", within the computer center. A Help Desk provides users with a single service facility for two way communications about user complaints, service status, downtime and other problems. An effective Help Desk needs a good in-place information system that provides intelligent and timely answers to user's inquiries and/or complaints.

Another "center" concept that is taking hold in user service areas is that of the Information Center. Information Centers are user and/or systems groups specially trained in the use of query language/ report writer to provide fast turnaround to user requests for information, data analysis, special reports, and other one-shot information needs. Good information centers can provide a very powerful, quick-turnaround information response to management information requests.

Finally, a User Oriented Charge-out System facilitates communication and understanding between DP departments and users. A User Oriented Charge-out System is one based on user-understood business units rather than on technical computer-resource units. For a charge-out system to be truly effective, it must be easy to communicate and easy for a user to understand. From a user standpoint, this means stating DP costs in familiar terms; e.g., number of checks written (accounts payable), number of employees (payroll), etc.

SUMMARY AND CONCLUSIONS

Over the last few decades there has been a shift from an industrially based to an information based society. The impact of this shift on users and data processing personnel is massive; we are coping with information overload, threat of job loss, dissatisfaction with traditional DP practices, and illiteracy, not only technically, but in basic skills as well. What users want, and are willing to pay for, is the ability to locate, manipulate and analyze the information they need.

DP personnel must become "information managers" who are willing to become involved with users and user businesses. Experts have noted that it is the quality of user relations that will "make or break" the DP departments of the 80's. In order for new technology to be accepted, there must be a high touch component.

This paper has discussed several strategies to this end. DP personnel must first discover who the users of the DP services are (and should be); must identify and implement appropriate methods of user/DP involvement; and must provide effective user service.

It is important to remember that it is not technology that will solve our problems, with users or otherwise. When we fall into the trap of believing (or hoping) that technology will solve all our problems, we are actually abdicating the "high touch" of personal responsibility. In our minds, technology is always on the verge of liberating us from personal discipline and responsibility. Only it never does and it never will.

We, as technicians, must strive to be aware of ourselves; to develop the inner knowledge, the wisdom required to guide our exploration of technology. We must strive for a balance between the material wonders of the technology, and the spiritual demands of our human nature. It is from this position that we can truly make a difference.

REFERENCES

Naisbitt, John. Megatrends: Ten New Directions Transforming Our Lives. New York: Warner Books, Inc., 1982.

Synnott, William R. and William H. Gruber. Information Resource Management: Opportunities and Strategies for the 1980s. New York: John Wiley and Sons, Inc., 1981.

MANAGING SOFTWARE DEVELOPMENT USING THE CRITICAL PATH METHOD

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This paper discusses the advantages and techniques of managing major software projects through the use of the Critical Path Method (CPM). It discusses how to use CPM in the various phases of the software development cycle and illustrates its use in projects in which it has been successfully used at Dartmouth College. It emphasizes the positive effect of thinking about the activities necessary to get from start to finish of a project and developing a plan to accomplish those activities. A plan which can measure progress against time and can predict completion dates, show where slack time appears in the plan so that moving resources can be used to better achieve the objective. Also discussed is the flexibility of changing the plan as new activities are determined to be necessary and as new relationships among activities are discovered. Like any other method CPM has some disadvantages, these are discussed along with the advantages.

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MANAGING SOFTWARE DEVELOPMENT USING THE CRITICAL PATH METHOD

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WHAT IS THE CRITICAL PATH METHOD:

The Critical Path Method (CPM) is a project management tool which was developed by Admiral Rickover when managing the development of the first nuclear submarine. As CPM is used today, when supplied with the estimated length of time, the interdependence, and the resources allocated to each of the individual activities that make up a project, the software calculates the project schedule and identifies the longest route through the schedule, this route is called the critical path. By studying the schedule it may be possible to reschedule some activities or resources and shorten the length of the project. I shall illustrate the use of this tool in managing software projects.

SOFTWARE DEVELOPMENT CYCLE:

Before we can talk about using the Critical Path Method, we should first look at the software development cycle. At Dartmouth, our interpretation of the development cycle is shown in Illustration 1. It is broken down into four stages, INITIATION, DEFINITION, IMPLEMENTATION, and OPERATION. We further break down the DEFINITION stage into writing specifications, selecting the method of implementation, and the design of the system to be implemented. I have used The Critical Path Method during the INITIATION stage through the selection portion of the DEFINITION stage but find that, by the time we reach the design portion of the DEFINITION stage, we have a completely new project to look at. Thus, the first CPM gets us to the point of deciding upon the system, but the second CPM helps manage the actual development of the system decided upon.

Looking at the software development over time, it would look like Illustration 2. Although, for discussion purposes, we break the cycle into stages, it is not easy to recognize when one stage ends and the next begins. This illustration, taken from a U.S. Army study, shows the resource loading in man years per year over the life of the cycle. It also illustrates that ongoing modification and maintenance reaches some relatively constant state and lasts until the system is replaced.

INITIATION PHASE:

At Dartmouth, the cycle begins with some administrator determining that there is a need for automation or, as in the request in Illustration 3, a need for a replacement system. This requirement is officially recognized when a Systems Change Request is initiated. In this case, a new payroll system was deemed to be necessary.

In order to determine the need for a new payroll system and how to design it, we formed two committees. The steering committee consisted of the Treasurer, the Controller, the Director of Personnel, the Vice Provost for Computing and Planning, and the Director of Administrative Data Processing. The working committee consisted of the Controller, a representative of the Payroll Office, a representative of the Personnel Office, a project manager from the Administrative Data Processing Office and the Director of Administrative Data Processing as chairman.

After some organizational meetings, the first order of business was to brain storm all of the steps that would be necessary to determine:

- What are the needed features of a payroll system at Dartmouth?
- Should it be only a payroll system or should it be a combined payroll/personnel system?
- Should we develop it in-house or purchase a system?

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The purpose of the brain-storming session is to determine the activities that should be accomplished and entered into a Critical Path system. I am convinced that sitting down at the start of a project to determine the steps necessary to accomplish the job is well worth the effort even if a CPM is not used. The CPM merely is a vehicle that requires this type of planning, and if you went no further, it would be worth the effort.

The next step, after determining what activities need to take place, is to determine the order in which they need to be done, and if some can be started before others are finished. In other words, "What is the interrelationship among activities"?

The next step is to go back through the activities to determine who will be responsible for and what is the estimated time that it will take to accomplish each activity.

Armed with these three pieces of data about each activity, it is time to sit down and draw a sketch of how the plan will be carried out. In the system I was using in 1980 when this new payroll study was being conducted, I drew the first chart by hand as shown in Illustration 4. From this sketch and the data as to estimated time to accomplish activities, I created a file on our time-sharing system. The file, in turn, is the input to the CPM program which calculates start and end dates, critical path, and prepares a file of data necessary for a program which plots the results on a plotter. Illustrations 5, and 6 show the results.

DESIGN & IMPLEMENTATION PHASE:

As a result of the above study and another on student records, we ended up purchasing Information Associates' (IA) Z series Student Information System (SIS), and their Human Resources System (HRS). We already had their older batch Financial Accounting System (FAS). So, now it was time to go through the CPM process again. This time we broke the installation of these two systems into two different projects, each with its own project leader steering committee, working committee, and programmers. Obviously, there were many more activities to perform and there were many more dependencies among the activities.

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One thing that brings about the complexity is that HRS and SIS are dictionary-driven systems and each has four subsystems:

- HRS has Payroll, Personnel, Labor Distribution, Position Control.
- SIS has Admissions, Financial Aid, Student Records, and Billing and Receivables.

We next went through the same steps to develop the next CPM's:

o What are the activities that need to be accomplished?
o Who is going to be responsible for each activity?
o What is the estimated time each activity will consume?
o What is the sequence in which the activities need to be accomplished?

The next thing was to draw up a sketch of these activities, enter the data into files, and then run the programs to create the reports and the charts showing the timing and relationships. Illustrations 7 and 8 show our first cut at the two systems.

At this point, we come to the realization that now we have a plan, but things never go exactly as we plan. That is where managing software using CPM becomes a very useful tool. Since all of the data is on a computer, it is relatively easy to change the plan and recalculate the whole project.

Part of the trick of using CPM as a management tool is to be sure to define activities such that it is fairly easy to recognize when the activity is finished. Next develop a reporting system that keeps track of the target dates for each activity which requires each responsible person to report when the activity is finished or let you know how much longer it will take. I use a system which keeps track of all the work each individual is currently charged with accomplishing. I have a feed from the CPM system to that system so that target dates are updated each time the CPM changes. Illustration 9 is a sample of what I call the targets report. It is produced once each week. From this report, I regularly am reminded of target dates which have not been met. It also requires each individual to give me updated estimates of when the target can be met. If their estimate seems out of line or moves critical dates, then I will sit down with them to find out what the problems are. Maybe I can move some other activity from that person to someone else, or give them more resources, or maybe we just have to accept the delay.

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At least, I know in a timely manner what has caused the delay and how it effects the ultimate target date.

Illustration 10 shows the SIS CPM three months into the implementation stage. Note that the end date moved from December, 1984, to April, 1985, and the critical path moved from Billing and Receivables to Student Records. The primary reason for this was that, because Dartmouth has four equal terms a year and students can select the terms they want to attend, we needed an algorithm to determine which students were really students each term. The IA system did not have this capability so we had to generate it ourselves.

The CPM's I have shown you to this point were all generated with home-grown CPM software. Over the past year, Dartmouth has joined the Apple Consortium and has been introducing the Apple Macintosh computer into the student's life. As part of this process, I now have an Apple Lisa which has a fabulously easy CPM system. Illustration 11 shows the SIS system CPM as it existed in October, 1984. The further we get into the implementation, the more activities we find need to be accomplished. We are still saying we will be fully operational in the summer of 1985.

ADVANTAGES AND DISADVANTAGES OF CPM:

I am convinced that CPM is well worth the effort in managing software development projects, yet like anything else, there are some disadvantages.

The primary disadvantage is that programmers are like all other human beings, they have a great deal of work to do, and when they see a target date that is a month or more away, they say to themselves, "I'll get to that tomorrow," until there isn't enough time to get the job done by the target date.

The primary advantage is that you have a plan that everyone knows about, has participated in, and lays out the activities needed to accomplish the job. Creating and living by a plan is worth every bit of effort that is put into creating and maintaining the CPM.

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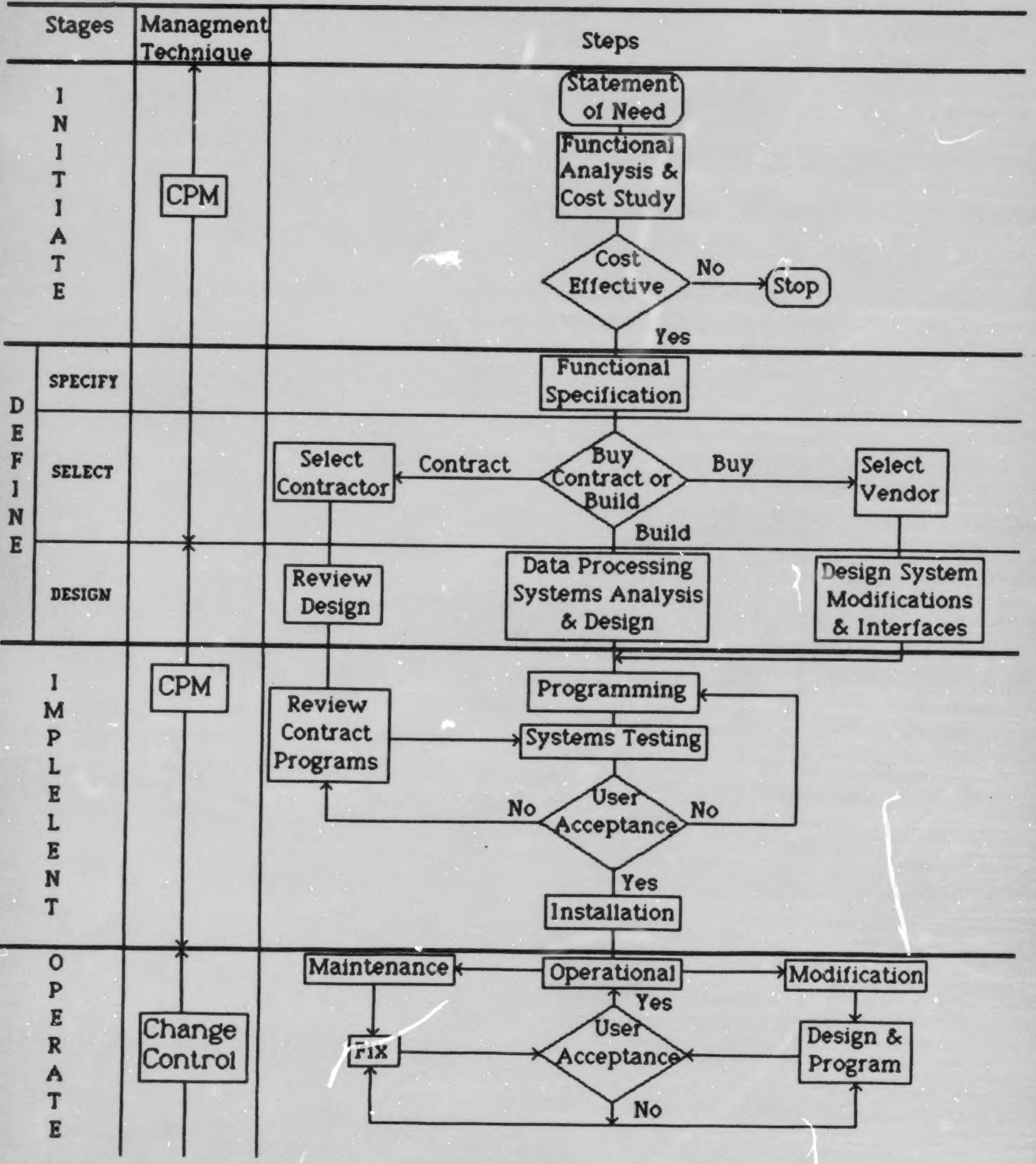
Dartmouth College
MIS Development Cycle


Stages
Managment Technique
Steps
INITIATE
CPM
Statement of Need
Functional Analysis & Cost Study
Cost Effective
No
Stop
Yes
DEFINE
SPECIFY
Functional Specification
SELECT
Select Contractor
Contract
Buy Contract or Build
Buy
Select Vendor
Build
DESIGN
Review Design
Data Processing Systems Analysis & Design
Design System Modifications & Interfaces
IMPLELENT
CPM
Programming
Review Contract Programs
Systems Testing
No
User Acceptance
No
Yes
Installation
OPERATE
Change Control
Maintenance
Operational
Modification
Yes
Fix
User Acceptance
Design & Program
No

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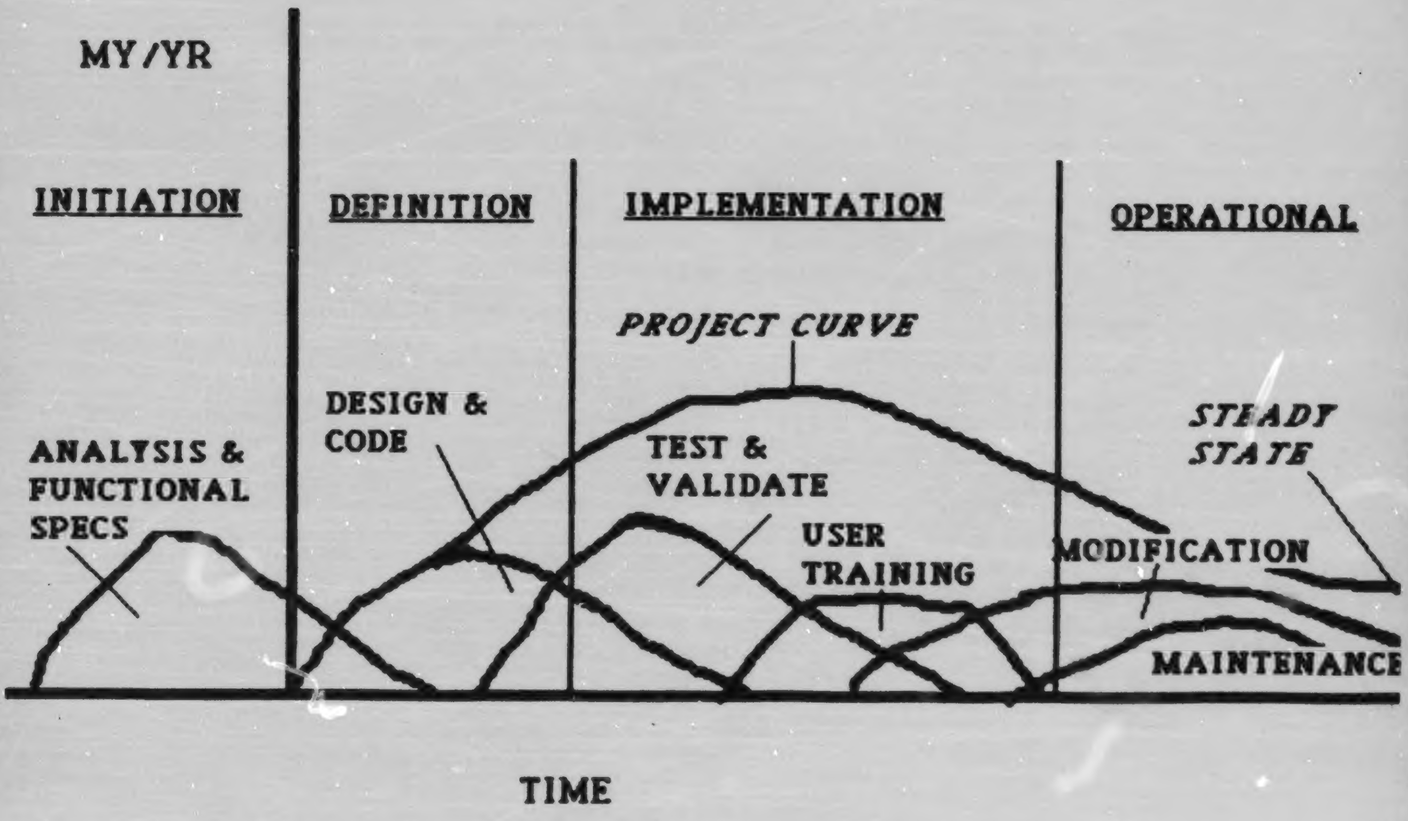
SOFTWARE DEVELOPMENT CYCLE



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KIEWIT

DARTMOUTH COLLEGE DATA PROCESSING
JOB DOCUMENTATION

Administrative System Change Request (SCR)

Name Bill Davis	Phone 3953	Date Submitted 14OCT80

System to be Changed: Payroll

Short Title of Change: Develop a new Payroll system

Describe the Change Requested (use additional blank pages if necessary)

1. Participate in design of new Payroll system
2. Help determine if to buy or build
3. If build is decision, then design, program and test new system
4. If buy is decision, help install and test new system

Enclosures		Approval of User Contact	
☐ Sample Input	☐ Other Documents	Change Authorized Bill Davis	Change Accepted
☐ Sample Output		Date Oct 14, 1980	Date

FOR USE BY ADMINISTRATIVE SUPPORT

Estimator	Programmer(s) Assigned Ron

Time to Change Man/Weeks		Work Dates			Approved for Work	
Estimated	Actual	Start	Target	Actual	OK to Work	Change Approved
		801014	821231			

Programs to be Changed	SCR Number PR-32

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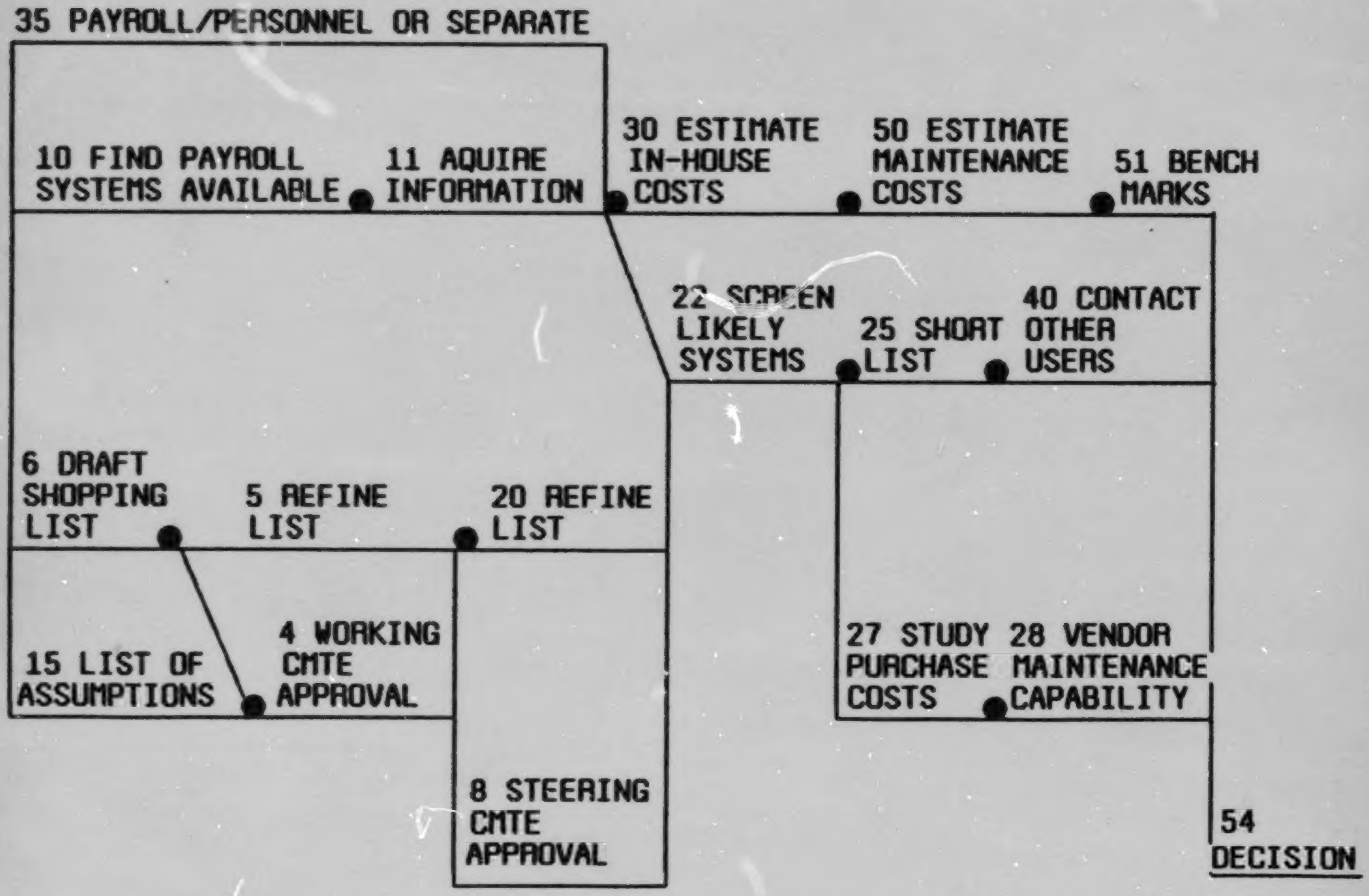
PAYROLL PRELIMINARY SKETCH


35 PAYROLL/PERSONNEL OR SEPARATE
10 FIND PAYROLL SYSTEMS AVAILABLE
11 AQUIRE INFORMATION
30 ESTIMATE IN-HOUSE COSTS
50 ESTIMATE MAINTENANCE COSTS
51 BENCH MARKS
22 SCREEN LIKELY SYSTEMS
25 SHORT LIST
40 CONTACT OTHER USERS
6 DRAFT SHOPPING LIST
5 REFINE LIST
20 REFINE LIST
15 LIST OF ASSUMPTIONS
4 WORKING CMTE APPROVAL
27 STUDY PURCHASE COSTS
28 VENDOR MAINTENANCE CAPABILITY
8 STEERING CMTE APPROVAL
54 DECISION

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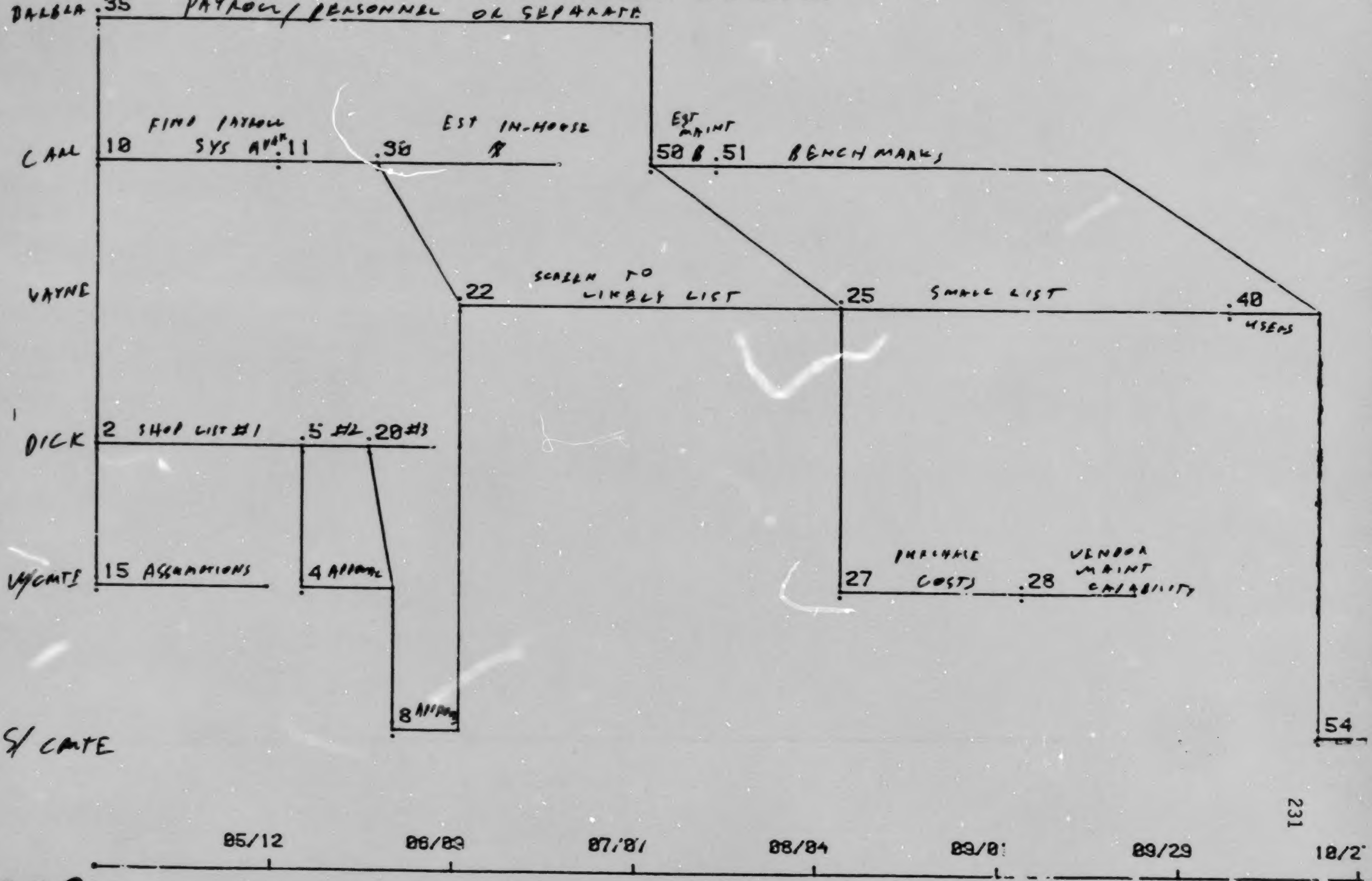
DARTMOUTH PAYROLL PROJECT 04/16/81


DARBRA .35
PAYROLL/PERSONNEL OR SEPARATE
CARL 18
FIND PAYROLL SYS AVAIL .11
.30
EST IN-HOUSE
EST MAINT
50 & .51
BENCHMARKS
WAYNE
.22
SCREEN TO LIKELY LIST
.25
SMALL LIST
.40
USERS
DICK
2 SHOP LIST #1
.5 #2
.20 #3
W/CMTS
15 ASSUMPTIONS
4 APPROVAL
8 APPROVAL
27
PURCHASE COSTS
.28
VENDOR MAINT CAPABILITY
54
S/ CMTE
05/12
06/03
07/01
08/04
09/01
09/29
10/2

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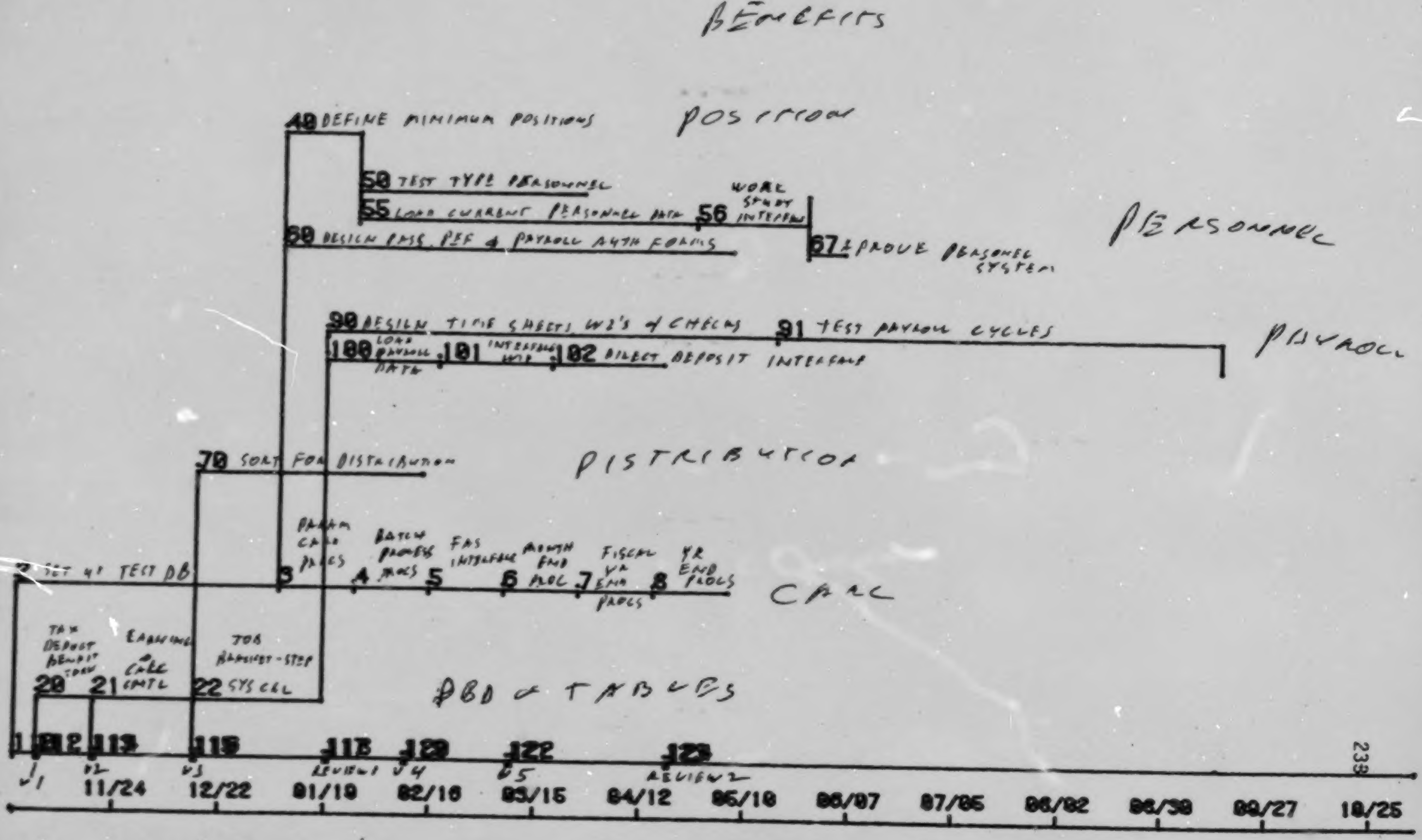
DARTMOUTH PAYROLL PROJECT
Projection as of 04/16/81

NUM	PERSON	ACTIVITY	EARLIEST START DATE	MEAN COMPLETION TIME (MCT)	EARLIEST COMPLETION DATE
55	--	START	04/14/81	DUMMY	04/14/81
2	DICK	PREPARE #1 DRAFT SHOPPING LIST	04/14/81	35 CP	05/19/81
4	W/CMTE	APPROVE DRAFT SHOPPING LIST	05/19/81	14 CP	06/02/81
5	DICK	#2 DRAFT SHOPPING LIST	05/19/81	10	05/29/81
8	S/CMTE	APPROVE SHOPPING LIST	06/02/81	10 CP	06/12/81
10	WAYNE	FIND PAYROLL SYSTEMS AVAILABLE	04/14/81	40	05/25/81
11	CARL	AQUIRE INFO ABOUT SYSTEMS	05/25/81	15	06/09/81
15	W/CMTE	PREPARE LIST OF ASSUMPTIONS	04/14/81	35 CP	05/19/81
20	DICK	#3 DRAFT OF SHOPPING LIST	05/29/81	10	06/08/81
22	WAYNE	SCREEN SYSTEMS TO LIKELY LIST	06/12/81	58 CP	08/10/81
25	WAYNE	ELIMINATE TO SMALL LIST	08/10/81	60 CP	10/09/81
27	W/CMTE	WORK UP COST OF PURCHASE	08/10/81	28	09/07/81
28	W/CMTE	VENDOR MAINT ABILITY & COST	09/07/81	17	09/24/81
30	CARL	ESTIMATE IN-HOUSE COSTS	06/09/81	28	07/07/81
35	BARBRA	PAYROLL/PERSONNEL OR SEPARATE	04/14/81	85	07/08/81
40	WAYNE	CONTACT USERS	10/09/81	14 CP	10/23/81
50	CARL	ESTIMATE IN-HOUSE MAINT COSTS	07/08/81	10	07/18/81
51	CARL	RUN BENCHMARKS	07/18/81	60	09/16/81
54	S/CMTE	PURCHASE OR BUILD DECISION	10/23/81	14 CP	11/06/81
1	--	DECISION	11/06/81	DUMMY	11/06/81

HUMAN RESOURCES SYSTEM 01/09/84



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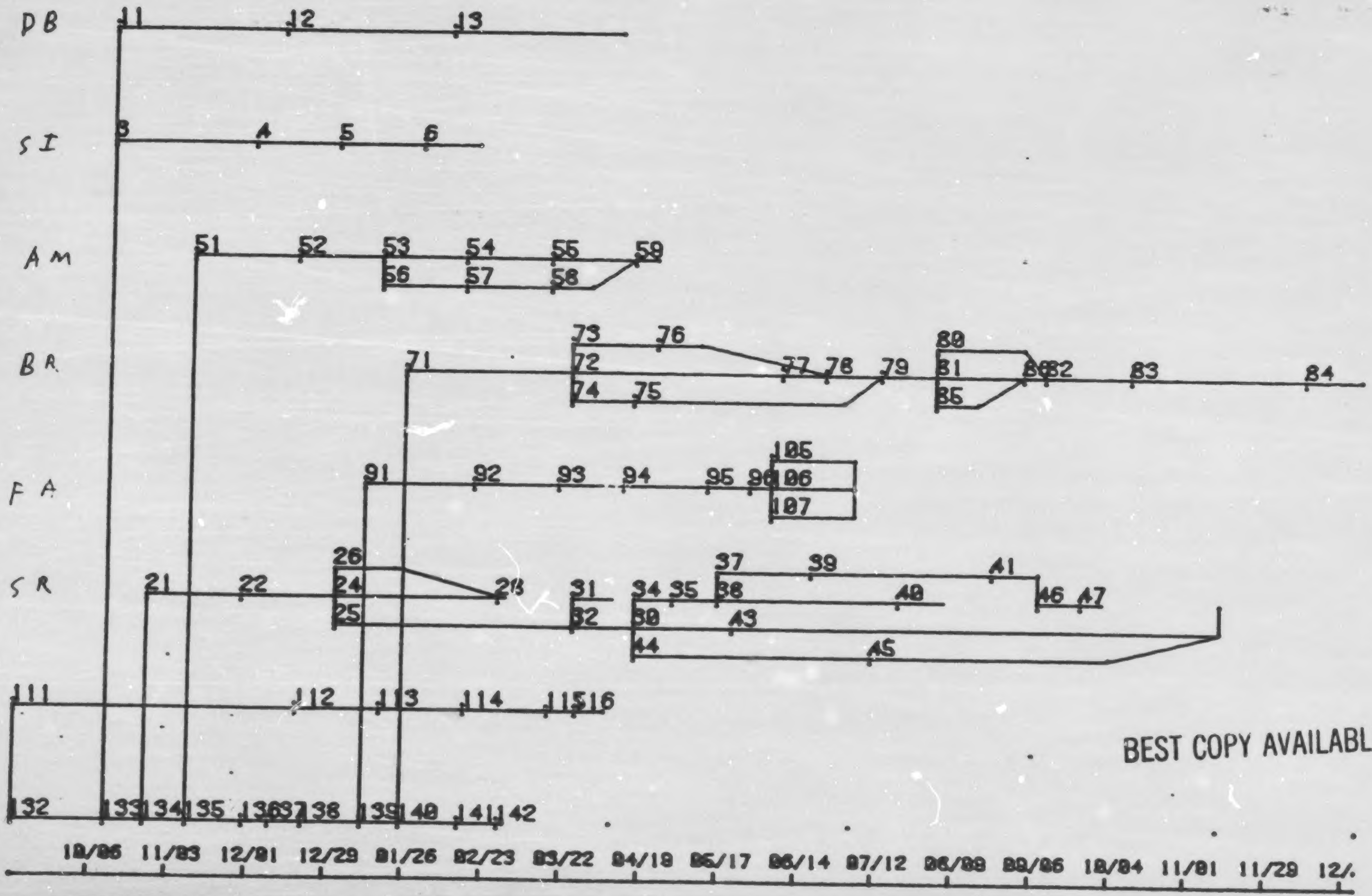
STUDENT INFORMATION SYSTEM 01/26/84


DB
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07/12
08/09
09/06
10/04
11/01
11/29
12/.

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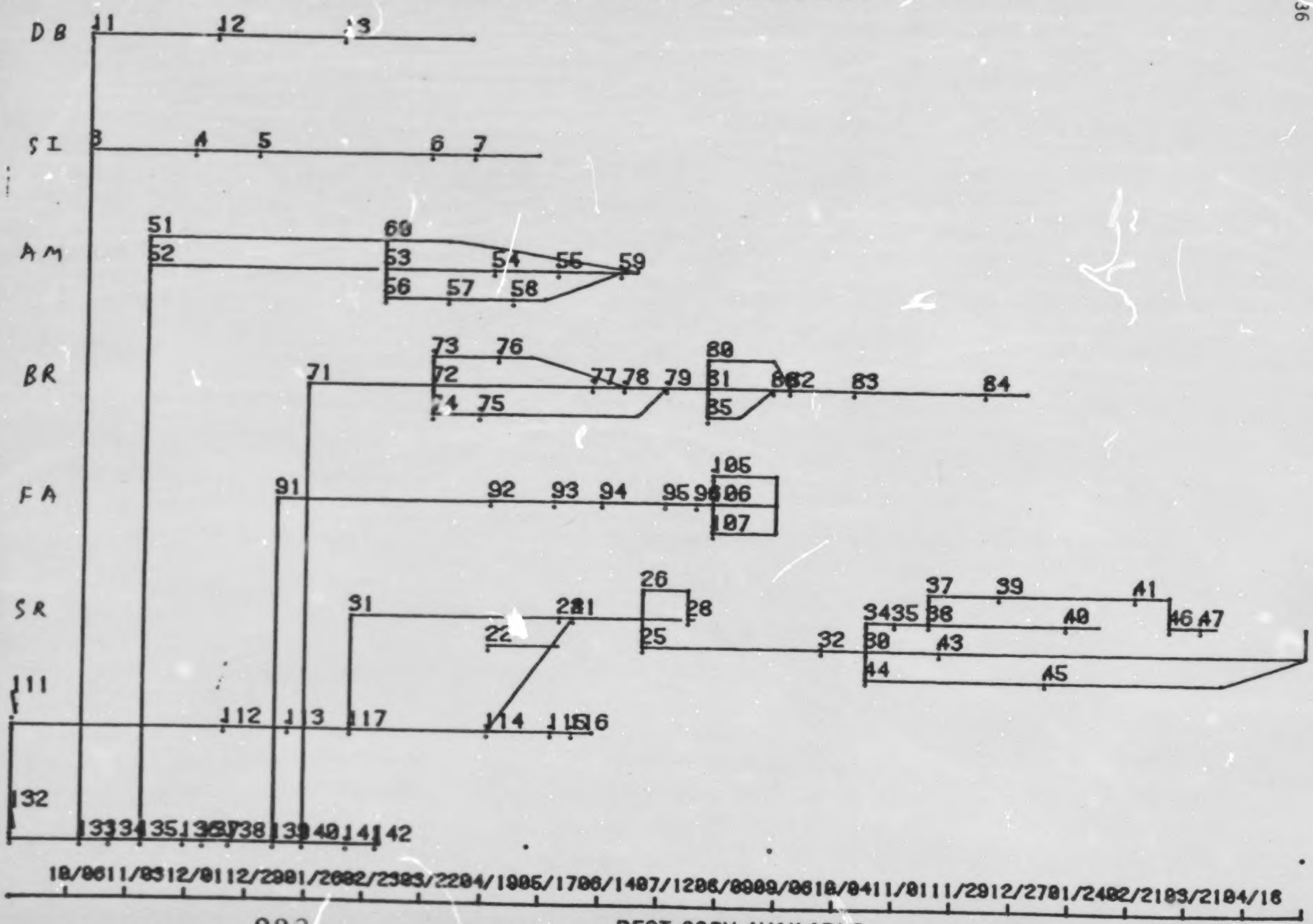
```
SCR'S PAST TARGET. PLEASE INDICATE NEW TARGET DATE.

10/08/84

PROG         CODE  SCR  STATUS      START   TARGET  N_TARGET
DESCRIPTION
------------------------------------------------------------

CARL          HR   542  PROG        840823  840928  ..............
PROGRAM POSITION REPORT FOR PRESIDENT

CARL          FS   100  PROG        840710  841001  ..............
ADD QUARTERLY BUDGET COLUMN TO QUARTERLY ROLL UP

PHIL          PR    76  PROG        840725  840925  ..............
HOLIDAY PAY FOR HANOVER INN

PHIL          VR     4  PROG        840806  841001  ..............
VIOLATION-PAYROLL-ACCOUNTS RECEIVABLE INTERFACE

RON           HR   540  PROG        840928  841005  ..............
REVIEW DRAFT REPORT WITH DEPARTMENTS
```

STUDENT INFORMATION SYSTEM 04/04/84


DB
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FA
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SR
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10/0611/0312/0112/2801/2002/2303/2204/1905/1706/1407/1206/0909/0610/0411/0111/2912/2701/2402/2103/2104/16

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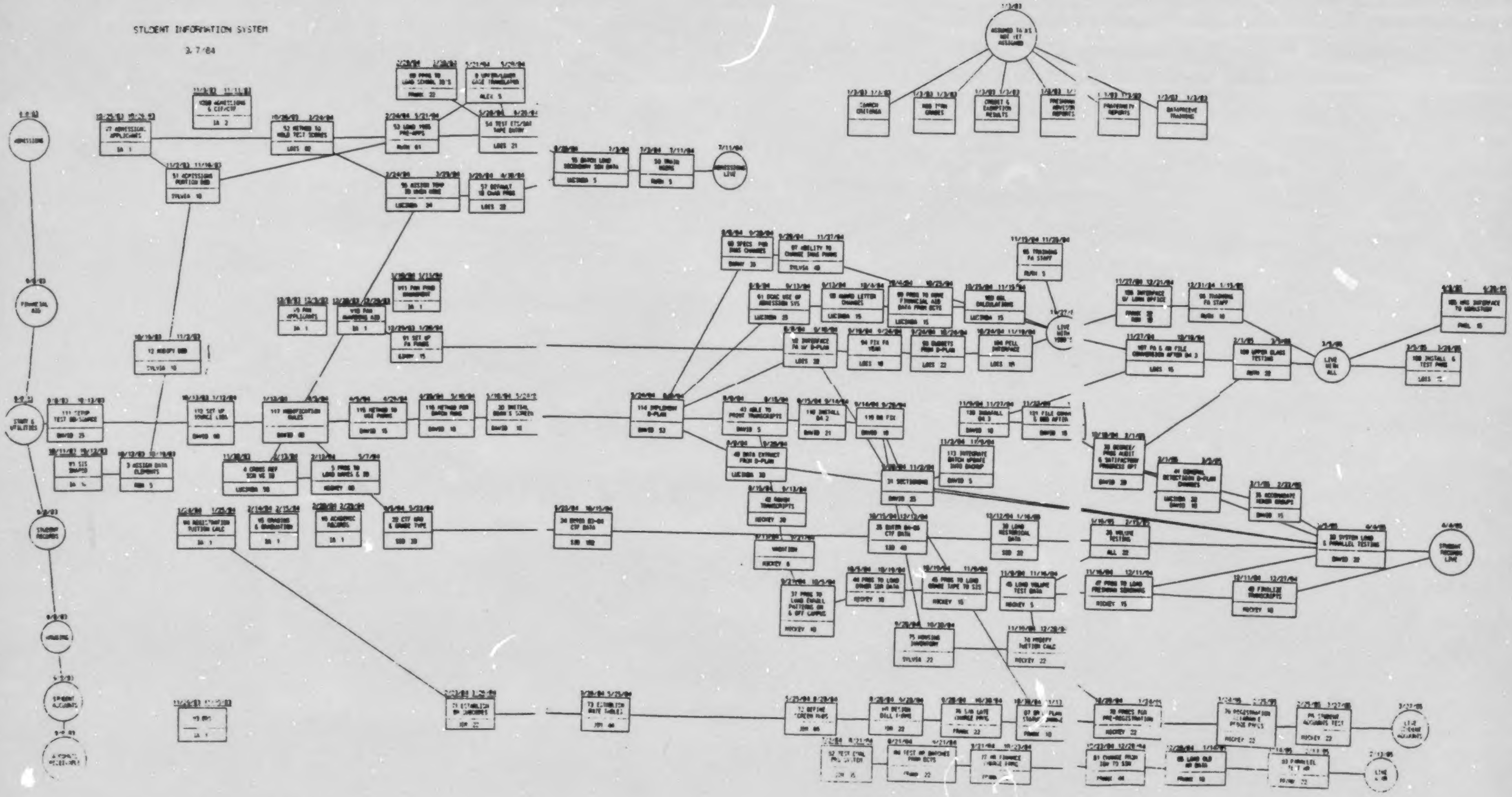
STUDENT INFORMATION SYSTEM

2/7/84


ADMISSIONS
FINANCIAL AID
START & UTILITIES
STUDENT RECORDS
HOUSING
STUDENT ACCOUNTS
ADMISSIONS LIVE
STUDENT RECORDS LIVE

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Track III
Innovative Technologies

Coordinator:
Allan B. MacDougall
Southwestern College

Robert Roberson
University of South Carolina

Robert Chew
Bentley College

Bruce Alexander
Michigan State University

Electronic Mail and Inter-campus Networks: Uses and Users

by

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and

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BITNET: UPDEGROV @ EDUCOM

ABSTRACT

Several colleges and universities (Carnegie-Mellon, Dickinson, Stanford, et al.) have developed electronic mail systems for administrators and faculty on the campus. Somewhat independently, inter-campus networks serving primarily computer scientists (ARPANET, CSNET) have achieved widespread use. The rapid growth of general purpose, inter-campus networks, like BITNET and MAILNET, indicates that a new phenomenon is underway -- frequent, electronic communication for non-computer specialists with colleagues around the country and around the world. Examples of network use on several campuses and at EDUCOM demonstrate this important new capability.

INTRODUCTION

At CAUSE '83, John W. McCredie reviewed the history, status, and prospects for "Gateways Among Academic Computer Networks," focusing on

- rationales for networking: resource sharing and communication;
- examples of national academic networks: ARPANET, BITNET, CSNET, EDUNET, MAILNET, USENET, and library networks (OCLC, RLIN, and WLN); and
- future trends:
    - proliferation and growth of networks,
    - need for gateways,
    - problems in addressing standards and pricing,
    - need for management,
    - more international connections.

Despite several significant events in the intervening year, McCredie's view remains valid: notwithstanding some organizational and operational shortcomings, networks are becoming increasingly useful tools in the academic community. The extent of this usage is illustrated below.

ACADEMIC NETWORKS: 1984 UPDATE

The creation of a Network Support Center for BITNET and the discussion of a federally-sponsored network for scientists were the major academic networking news items of the past year. The Network Support Center is the result of a joint proposal from City University of New York and EDUCOM, which was funded by IBM in mid-summer. The Network Support Center consists of a BITNET Information Center (BITNIC) at EDUCOM, focused on informational, programmatic, and administrative needs of BITNET; and a BITNET Development and Operation Center (BITDOC) at CUNY, devoted to technical, systems maintenance, and software development efforts for BITNET. The Network Support Center is headed by Dr. Ira H. Fuchs, who holds the positions of Vice Chancellor for University Systems at CUNY and Executive Director of Networking Activities at EDUCOM. An IBM 4361 computer, related hardware and software, and operating funds were provided by IBM to create the NSC.

Increasing availability of and access to supercomputers is the mandate of the new Office of Advanced Scientific Computation at the National Science Foundation. The agency has announced programs both to support research to be performed at existing supercomputer centers and to build new centers; in addition discussion is underway to facilitate network access to supercomputers, initially using existing networks, and ultimately using a new high-bandwidth medium (possibly satellite communication). Interestingly, remote access to supercomputers is rekindling interest in resource sharing just when it appeared that communications -- electronic mail, conferencing, file transfer -- would dominate networking discussions.

By year-end, BITNET had extended to 86 U.S. campuses, 14 Canadian campuses (NETNORTH), 70 European campuses (EARN), with gateways to ARPANET and CSNET (over 1300 nodes), CCNET (6 campuses), MAILNET (26 campuses), and VNET (IBM's internal 1600-machine corporate network). Topologies for the BITNET-NETNORTH-EARN store-and-forward network and the MAILNET star-network (with its central polling computer at MIT) are shown in Figures 1, 2, and 3.

USES and USERS

Dickinson College, in Carlisle, PA, has had an active and growing community of electronic mail users and was a charter participant in MAILNET (using its DEC pdp-11 running RSTS/E). To use MAILNET, the college first had to create an interface to its locally-developed electronic mail system, DREAMS. (Subsequently, several colleges acquired DREAMS in order to join the MAILNET community.) Communication over MAILNET has averaged about 100-150 messages per month with access limited to the administrators and computer center staff who use the pdp-11. Usage is expected to increase when the MAILNET interface is installed on the VAX 11/780 that serves faculty.

MAILNET use has been focused on:

- information interchange among counterparts at other institutions;

- exchange of data and source programs; and

- access to online mailing lists, including an especially useful one on the KERMIT communications package supported by Columbia University.

At Yale University, a recent online query to BITNET sites turned up the following uses of the network:

- faculty moving to and from Yale use BITNET both to communicate with new (old) colleagues and to ship files to their new institution;

- physicists peruse an online data base of preprints and journal articles at the Stanford Linear Accelerator Center;

- students contact friends at other institutions for help on computer programming assignments;

- graduate students on remote internships use BITNET to analyse dissertation data resident on the Yale computer;

- social scientists collaborate with colleagues in Boston and New York by shipping raw and transformed data and discussing the results over the network;

- the university press uses the network to communicate with authors, editors, and indexers;

- an administrator co-authored a paper with a colleague at another university, who also used BITNET to edit drafts while on vacation.

At EDUCOM, long a proponent and user of electronic media, use of MAILNET, BITNET, et al. is extensive:

- 6 of 7 members of the Trustees' executive and finance committee use BITNET to communicate with staff and each other;

- staff use the network to communicate with consultants active in the EDUCOM Consulting Group, conference and seminar leaders, conference local arrangements committees, authors and readers of publications, and colleagues who are traveling;

- online inquiry and registration for the EDUCOM conference and seminars was facilitated by BITNET and MAILNET for the first time in 1984;

- arranging interviews and site visits for the EDUCOM-Educational Testing Service study of Computer-Intensive Environments was faster and simpler;

- maintenance and system development of EFPM and HEDS, both resident at Cornell, are facilitated by file transfer between a Cornell mainframe and the EDUCOM VAX 11/750;

- the network is used for internal management of BITNET, including update of routing tables, software exchange, and documentation.

CONCLUSIONS

For campuses with both a robust electronic mail system and a connection to one of the major general purpose academic networks, inter-campus communication is already commonplace and important, not only for computer center staff and technically-trained faculty but also for humanists, editors, and institutional researchers. In fact, on one campus, the online query about network usage was cause for alarm among some devoted users, who assumed that network termination might be under consideration!

Nevertheless, only a small fraction of our colleagues in colleges and universities now have access to these networks -- either for lack of software or for lack of the network connection. Moreover, the inter-network gateways are not always reliable or "user-friendly", and we are just beginning to understand how best to integrate electronic mail, conferencing, and bulletin boards into our professional work styles. Fortunately, organizations such as the BITNET Network Support Center have been established to address these problems, and the growing number of enthusiastic users indicates that inter-campus electronic communication is here to stay.

Figure 1: BITNET/NETNORTH Topology as of 01/03/85

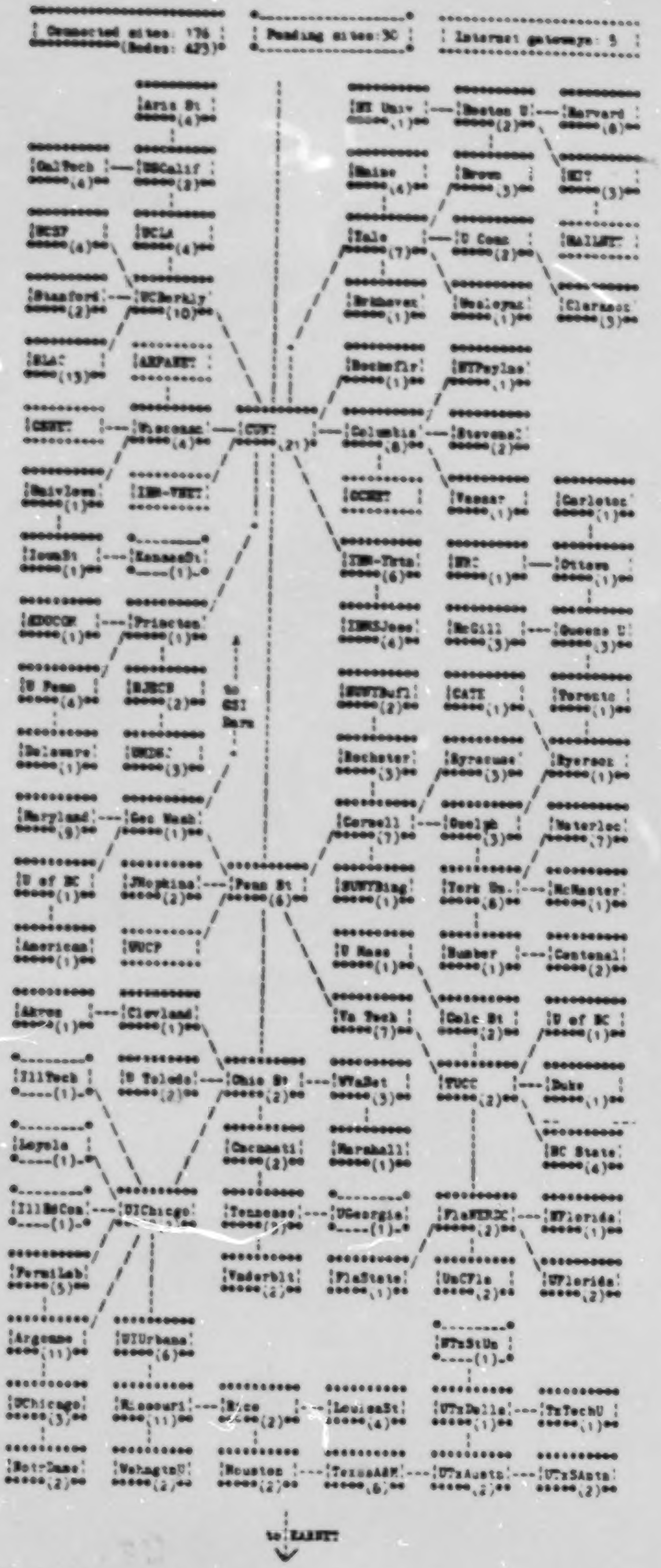
Connected sites: 176
Nodes: 425
Pending sites: 30
Internet gateways: 5
Ariz St (4)
CalTech (4)
UCCalif (2)
UCSF (4)
UCLA (4)
Stanford (2)
UCBerkly (10)
SLAC (13)
ARPANET
CSNET
Wisconsn (4)
CUNY (21)
UnivIowa (1)
IBM-YHT
IowaSt (1)
KansasSt (1)
EDUCOM (1)
Princton (1)
U Penn (4)
BJECB (2)
to GSI Darm
Delaware (1)
UMDNJ (3)
Maryland (9)
Geo Wash (1)
U of MC (1)
JHopkins (2)
Penn St (6)
American (1)
WUCP
Akron (1)
Clevland (1)
IllTech (1)
U Toledo (2)
Ohio St (2)
Loyola (1)
IllMdCon (1)
UIChicgo
FermiLab (5)
Argonne (11)
UIUrbana (6)
UChicago (3)
Missouri (11)
Rice (2)
LouisaSt (4)
UTxDalla (1)
TxTechU (1)
NotrDame (2)
WshngtnU (2)
Houston (2)
TexasA&M (6)
UTxAustn (2)
UTxSAntn (2)
to EARNET
NY Univ (1)
Boston U (2)
Harvard (6)
Maine (4)
Brown (3)
MIT (3)
Yale (7)
U Conn (2)
MAILNET
Brkhaven (1)
Wesleyan (1)
Clarkson (3)
Rockefir (1)
NYPoylno (1)
Columbia (8)
Stevens (2)
OCNET
Vassar (1)
Carleton (1)
IBM-Trtu (6)
NRC (1)
Ottawa (1)
IBMSJose (4)
McGill (3)
Queens U (3)
SUNYBufl (2)
CATE (1)
Toronto (1)
Rochester (3)
Syracuse (5)
Ryerson (1)
Cornell (7)
Guelph (3)
Waterloo (7)
SUNYBing (1)
York Un. (6)
McMaster (1)
U Mass (1)
Humber (1)
Centenal (2)
Va Tech (7)
Calc St (2)
U of MC (1)
WVaNet (5)
TUCC (2)
Duke (1)
Marshall (1)
NC State (4)
Cincnnati (2)
Tennesee (2)
UGeorgia (1)
FlaNERDC (2)
NFlorida (1)
Vaderblt (2)
FlaState (1)
UnCFla (2)
UFlorida (2)
NTxStUn (1)

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Figure 2: EARN Topology as of 01/03/85

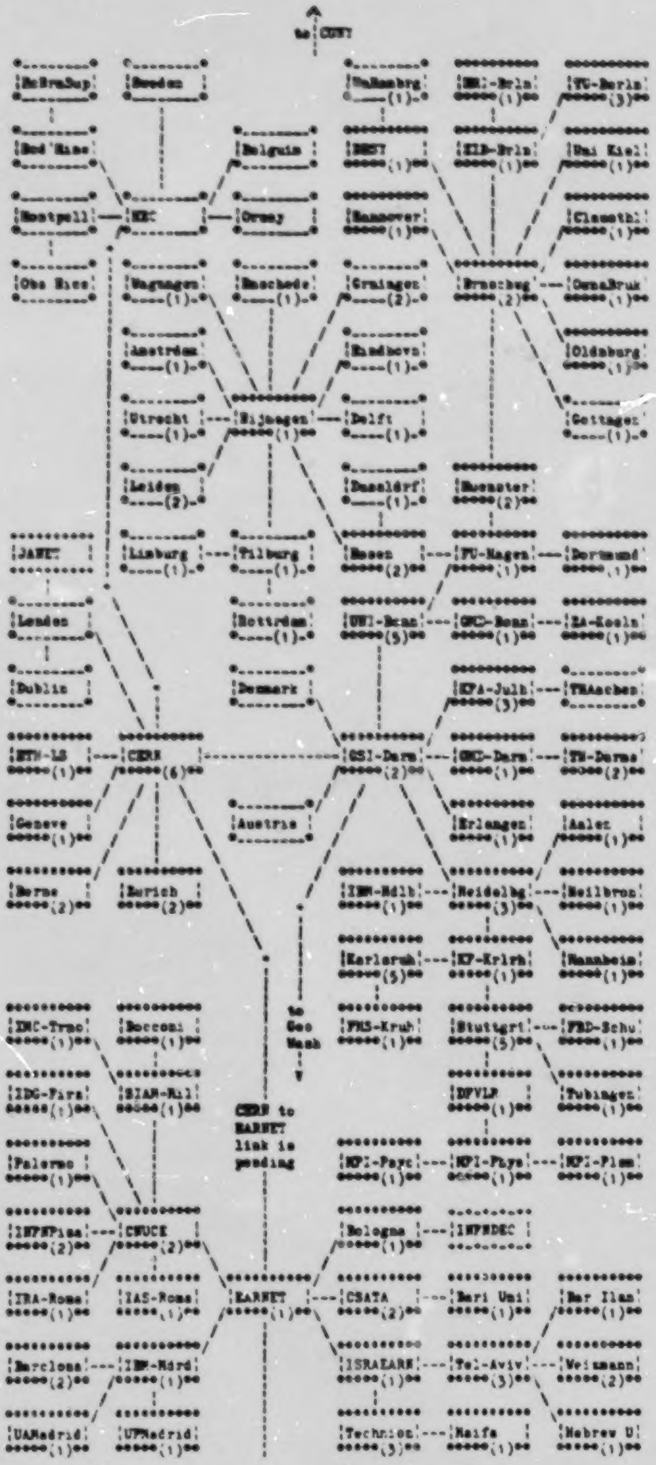
to CUNY
BeBruSup
Sweden
UniHambrg
HMI-Brln
TU-Berlin
Bad Rime
Belgium
DESY
ZIB-Brln
Uni Kiel
Montpell
EEC
Orsay
Hannover
Clausthl
Obs Nice
Wagengen
Enschede
Groningen
Brnschwg
OsnaBruk
Amstrdam
Eindhovn
Oldenburg
Utrecht
Nijmegen
Delft
Gottingen
Leiden
Dusseldrf
Muenster
JANET
Limburg
Tilburg
Essen
FU-Hagen
Dortmund
London
Rotterdam
UNI-Bonn
GMD-Bonn
ZA-Koeln
Dublin
Denmark
KFA-Julh
THAachen
ETH-LS
CERN
GSI-Darm
GMD-Darm
TH-Darms
Geneve
Austria
Erlangen
Aalen
Berne
Zurich
IBM-Hdlb
Heidelbg
Heilbron
Karlsruh
KF-Krlrh
Mannheim
IBM-Trnc
Bocconi
to Geo Wash
FHS-Kruh
Stuttgrt
FHD-Schu
IDG-Pisa
SIAM-Mil
DFVLR
Tubingen
CERN to EARNET link is pending
Palermo
MPI-Psyc
MPI-Phys
MPI-Plas
INFNPisa
CNUCE
Bologna
INFNBEC
IRA-Roma
IAS-Roma
EARNET
CSATA
Bari Uni
Bar Ilan
Barclona
IBM-Mdrd
ISRAEARN
Tel-Aviv
Weizmann
UAMadrid
UPMadrid
Technion
Haifa
Hebrew U

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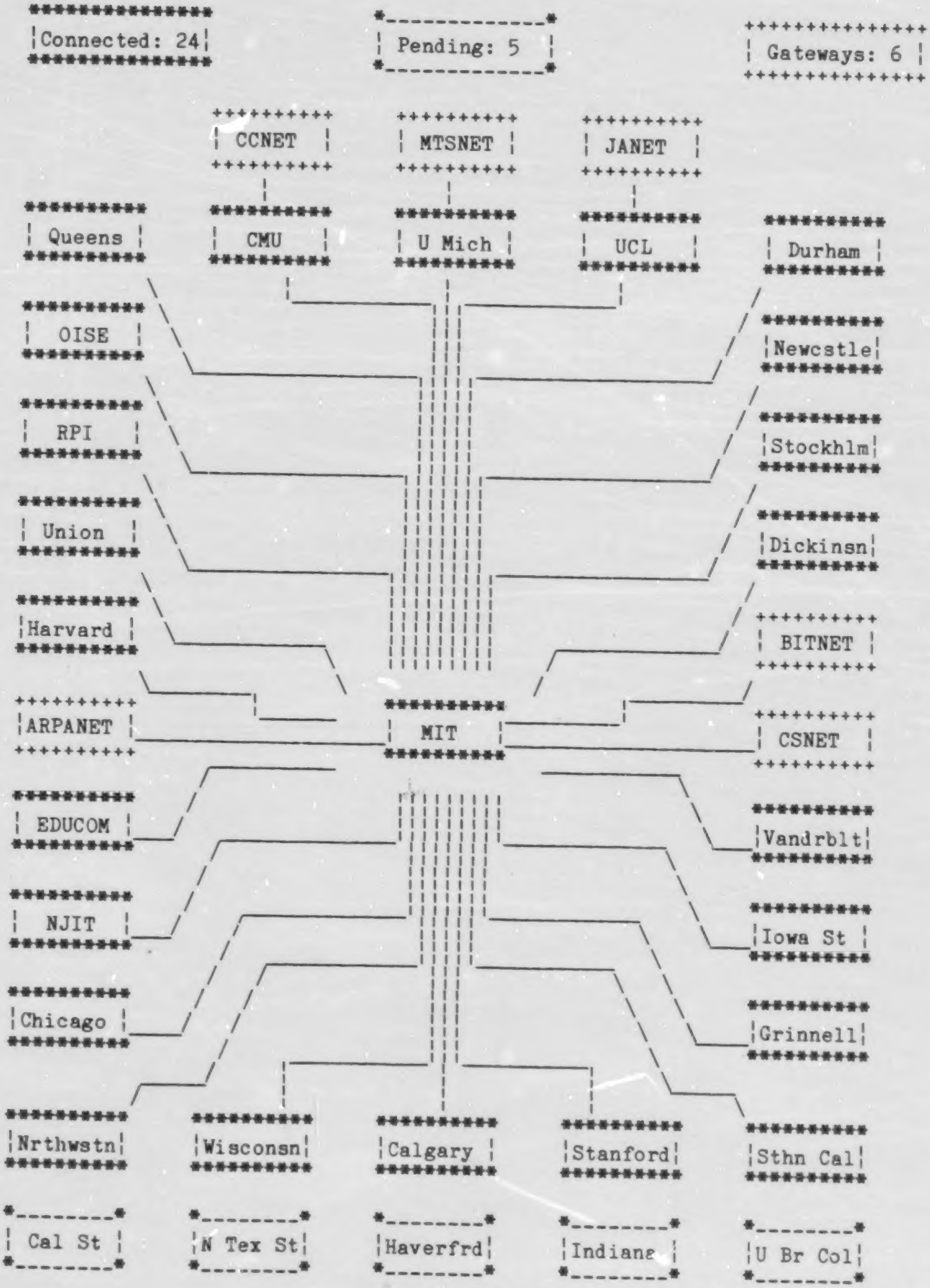
Figure 3: MAILNET Sites, 02/01/85


Connected: 24
Pending: 5
Gateways: 6
CCNET
MTSNET
JANET
Queens
CMU
U Mich
UCL
Durham
OISE
Newcstle
RPI
Stockhlm
Union
Dickinsn
Harvard
BITNET
ARPANET
MIT
CSNET
EDUCOM
Vandrblt
NJIT
Iowa St
Chicago
Grinnell
Nrthwstn
Wisconsn
Calgary
Stanford
Sthn Cal
Cal St
N Tex St
Haverfrd
Indiana
U Br Col

BIBLIOGRAPHY

Brown, George W., James G. Miller, and Thomas A. Keenan. EDUNET: REPORT OF THE SUMMER STUDY ON INFORMATION NETWORKS. New York: John Wiley & Sons, Inc., 1967.

Fuchs, Ira, H. "BITNET--Because It's Time," PERSPECTIVES IN COMPUTING, 3, No. 1, March 1983, pp. 16-27.

Greenberger, Martin, et al. (eds.) NETWORKS FOR RESEARCH AND EDUCATION. Cambridge, MIT Press, 1974.

McCredie, John, W. "Gateways Among Academic Computer Networks," CAUSE '84 PROCEEDINGS, pp. 187-198.

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For more information on BITNET, EDUNET, and MAILNET, contact EDUCOM Networking Activities, P. O. Box 364, Princeton, NJ 08540; telephone (609)-734-1878.
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NETWORKED STUDENT WORKSTATIONS

George Pidot
Director
Campus-wide Computing
SUNY/Stony Brook

Networked Student Workstations

This the saga of one institution's attempt to upgrade computing services, particularly for its students. It stresses that technology alone does not hold the answer to our needs. Choice must be made for the particular environment, decision-making structure, and interpretation of educational mission.

Stony Brook is a large research oriented institution, in the New York State system focusing on the sciences, engineering, and medicine. Research contracts total nearly 45 million dollars annually. All programs are on a large campus stretching almost a mile and a half. The campus includes a 500 bed hospital which is heavily computerized.

The SUNY system is heavily bureaucratized, with strong central control exercised over most decision-making. Progress is achieved only slowly and with great effort, which encourages strategic purchasing with long lapse between major upgrades. A relatively tight budget has led to the squirreling of resources which frustrates coordination of spending, leading to uneven progress. It pays to create strategic bottlenecks which provide a justification for the acquisition of resources to solve the resultant problems. Internal decision making is heavily committeed, with consequent slowness of decision making. A small number of key individuals do strongly influence decisions.

Computing is heavily decentralized, with a very large number of research funded minicomputers (mostly VAX's) and well over 1,000 microcomputers (mostly IBM) little state money has been available for such acquisitions. Until recently, the Computing Center was conceived of narrowly providing only a limited set of mainframe services (Sperry 1100's). Aside from those in Computer Science which are tied together via an Ethernet, these systems function largely independently. Stand-alone word processing devices are in most departments (DEC or IBM). The Hospital utilizes its own IBM mainframe and unique patient care system. The kind and quality of services available are uneven across the institution.

A new Director was brought in to oversee all of computing in the institution - to provide some degree of rationalization and overall planning which - established structures have tended to resist. Efforts to move forward reflect the dichotomy of the traditional decentralization with the new focused leadership.

One emphasis is now on providing communication and integration of previously disparate systems. We have selected a large digital PBX from Rolm Corporation as a backbone for both voice and data communication, including all offices and student rooms. Original plans were for a voice-only solution. The integration occurred as the result of a working personal relationship between the Directors of Computing and Communication, who report to different Vice Presidents.

A substantial initiative in office automation was sponsored by the Provost to upgrade service in academic departments. The process was initiated through the typical committee approach, but impatience with progress led to a centrally directed project. We are now offering electronic mail and file transfer on a VAX running All-in-1.

Due to state constraints our mass purchasing agreements for micros are managed by the Research Foundation, but consulting support comes from the Computer Center Microlab. The agreements were negotiated independently from the usual goverance process; there has been little attempt to rationalize the acquisitions or to coordinate software. It is likely that most of the software was obtained in inappropriate copying.

The four SUNY University Centers in New York and the Central Administration have issued recently an RFP for acquisition of new mainframe for hardware and software.

This massive document was initiated by a collective effort from the campuses rather than the top down approach. Its premise is that there should be a common software and hardware environment both for the development of new administrative systems and the academic community. It presumes creation of a SUNY-wide network, based on packet switching. The RFP was written by and will be evaluated by the campuses directly. The emphasis is on flexibility of solutions which will be chosen by each campus. The acquisition is expected to continue over a three year period.

The Stony Brook portion focuses on hardware modularity and system connectivity.

My comments are centered on a project to improve student access to computing - Stony Brook Instructional Networked Computer (Project SINC.) Paucity of state funding and bureaucratic resistance to computing had combined to produce relatively limited access for mainframe based computing for students. While there was clearly a major need to enlarge and enhance this access, there was no clear definition of what kind of service was to provide nor for whom. Fortuitously, funding became available from an earmarked source specifically designed to enhance student computing. The amount is only a little over $20.00 per student annually, roughly adequate to provide a few minutes of computing per week. To stretch these resources and to encourage innovation and flexibility. Stony Brook decided to enter a joint three year project with a major vendor to use the latest technology in support of instruction.

Much debate ensued in the committee structure because of the computing demands for the limited funds. The innovative approach had to be sold to the state bureaucracy which expected the funds to be used only for off-the-shelf purchases. The state proscribed the use of monies for any form of staff support or physical rehabilitation. Further, Stony Brook was required to write a competitive bidding document to solicit vendor proposals which turned off some potential companies more accustomed to dealing on a negotiated basis. Candidly, the selection process had to weigh both the techincal sophistication of the proposals and the favorite vendors of individual faculty. Digital Equipment Corporation was finally selected and necessary approvals were secured.

The process from conception to the signing of a contract took one year. The contract is unusual in that it stipulates only total cost and the ultimate functional outcome rather than identifying a specific set of priced deliverables. This is to maximize flexibility and take advantage of unannounced products. The specific selection was based on a desire to acquire powerful systems, emphasizing connectivity and sharing of resources. DEC was to provide the basic software, including networking and file sharing software, under a site license to overcome the problem of multiple copies. This includes the commonly used languages at Stony Brook, word processing, spreadsheet, data base, and a courseware authoring system, which the institution is to use to develop specific programmatic materials.

The hardware has already gone through a number of evolutions, There will be six sites at disparate locations, each hosted by a college which provides space, security and supplies. The Computing Center will provide ultimate oversight, basic support, maintenance, consulting and training. At each site, there will be two dozen workstations (PrO 325's), which will share access to hard disk storage and table top laser printers. Internally the equipment at each site will be tied together by an Ethernet. In the long run the sites will be tied to each other and mainframe computing.

Students will be free to use any site. They will carry their own data on floppy diskettes. The shared hard disk will support both utility and course specific software which should substantially simplify the management and support by reducing the actual number of copies in existence.

A number of dichotomies must be addressed in mounting and defining the scope of such a project. The resolution of each is not simple, as it involves a weighing of alternative benefits and costs. In particular, the decisions must be strongly influenced by the underlying goals of the undertaking and inevitably by the views of the individuals who are doing the assessment.

Both with hardware and software, there is an inherent tension between the desire to have is the latest, product and settling for items which are readily available and thoroughly tested. When one enters into an agreement, premised on the acquisition of largely unannounced products, it is inevitable that there will be significant delay, confusion and frustration. This permits critics to suggest that the institution may have purchased phantom products.

There is an analogous tension between the desire to develop new and enhanced software, either from the vendor or inhouse vs. the need for a measure of operational stablilty, in order to produce services for the student. A two to three year timespan for installation of a functional project may seem entirely reasonable, to the developer. Yet this is more than half of the timespan that a student will spend at the institution. This creates frustration among the students who view themselves as having funded the project, but as yet have seen few benefits. This is exacerbated by unrealistic expectations on the part of both students and faculty as to the true cost of providing computing services, which they tend to view as "a free good."

One strain evident in the selection process was between choosing a technically, well-designed solution from vendors who offered generous amounts of their products and a more pedestrian set of offerings for which faculty had brand loyalty.

Another choice is between the creation of software unique to Stony Brook and acquisition of canned programs. There are clearly economies of scale and time savings in going with the latter, but academics charge that few relevant programs exist which they can effectively use in support of their courses, other than for utility functions such as word processing.

This also brings us back to site licensing which is essential in a networked solution, a question which most software houses have yet to address satisfactorily. A dramatic current example is SPSS. To equip the currently proposed network of workstations with this product alone would in theory cost over $100,000. In contrast, we currently support it on our mainframe for a small fraction of that total.

Another policy trade-off was between the need for uniformity for efficient management of the sites and the desire for local option and flexibility to meet individual needs best. This particular project utilizes the same hardware everywhere. Applications Software however may vary substantially.

A fundamental conflict in a joint undertaking is that between the interests of the manufacturer and those of the University. When one moves from a lofty definition of the joint benefits to be derived from such an enterprise to their practical implementation, the relations tend to become far more strained.

Ultimately it is reasonable, for the company to expect a profit, which emphasizes the delivery of current iron produced by a single vendor and in the software. The University, functions in a multi-vendor world, particularly with microcomputing, and wants a diverse set of solutions to student needs. It wants to work with the latest developments in hardware and software - tailored to meet its particular view of the world, whereas the company has a broader view of the market place in which customization and flexibility are relatively unimportant. The greater support inevitable in a developmental project tends to be looked on as a costly nonessential service. Availability of products and consequent delivery seems geared to meet corporate needs. I have sometimes thought that the situation might be alleviated by making the academic calender aligned with the corporate fiscal year! We have recieved versions of the latest systems which would otherwise have been unavailable, but usually late. We have not had significant problems with hardware arriving in inoperable condition, but we have all too often recieved the wrong items. The last beta test software comes but does not function with the hardware.

We have had great difficulty getting questions answered. The normal '800' number is uninformed about new systems in particular and techinical issues generally. Understandably the company has tried to husband the time of its engineers and technicians which it prefers to see dedicated to getting a new product to market rather than solving the particular problems of our institution.

Obvious lapses in the internal communications mechanisms of the company have led to frequent substantial additional delay, both in answering questions and in delivering new products. Some of the solutions proposed to meet our needs in fact proved to be internally incompatible even though employing products from the company. One might suggest that the company needs a degree of corporate as well as technical integration.

By no means do all of the problems involved in implementation lie merely between the company and the University. I have personally gained increasing admiration for Prince Machavelli in his ability to get warring city states to function as a larger entity, during my own attempts to reorient an inward looking Computing Center to get it to work with a badly divided and doubting community outside. Whether it is analyzing the true total cost to the institution of various alternatives, the location of jealously sought after hardware or the division of a limited resource pie, it is a essential to take a truly institution-wide point of view, yet such a stand rarely garners many votes.

A frustrating, but real, phenomenon is the revolution of rising expectations on the part of the users in the presence of new technology. This is heightened by the lure of unannounced products - particularly in an environment where users are not bearing the costs. One particular manifestation of this is an obvious divergence between the needs of the students and the desires of the faculty. Aside from the inherent competition for a scarce resource which is guaranteed to frustrate some of these demands, there is a fundamental incompatability in the kinds of service and equipment needed to satisfy many of them. Well organized, articulate 'haves' tend to drown out the emerging needs of the traditional 'have-nots'. This is exacerbated by the existence of multiple instant experts, offering their own favorite solutions to problems that they perceive. Anyone who attempts to offer aninstitution wide solution which is designed to support the needs of many is likely to be accused of a lack of technical sophistication and of attempting to force their own solutions on an intransigent minority. A faculty member who tinkers with their own micro in pursuit of their personal research interests is not always tolerant of the structured approach to provision of service on a large scale necessary in a production environment.

No analysis of the project would be complete with a consideration of costs. The popular view is that provision of computing services with micros is less costly than with traditional mainframes. It is premature make a hard assessment of the numbers from the present project, but it is clear that this view is open to question.

Any cost analysis must define carefully the service provided not simply connect hours but a more comprehensive unit which accounts for the qualilty, flexibility and availability of a system with appropriate software. As the value of people's time rises, and the cost of the hardware based service falls, it is no longer appropriate to demand high levels of utilization just to minimize the hardware cost. One needs to focus on the particular kinds of use to which systems will be put in order to assess their overall cost effectiveness at achieving an ultimate ends whether that be creation of an edited document, familiarization with aprogramming language or creation of a functioning model.

The rapid decline in the price of hardware, particularly memory, and the sharing of resources inherent in the current system, have pressed the hardware cost to very low levels. One does need to recognize the relatively short life of these systems, however.

In estimating the true software cost, the only fair basis is the real cost of legally obtained products provided via whatever system is in question. Too often the issue of illegal copying is politely ignored. One of the big attractions to the particular vendor chosen for Project SINC was availability of site licensing.

The cost of locally developed software is another matter. Any development undertaking will experience upfront costs. If the true opportunity costs of faculty time were calculated in the authoring of software, then such local products would become a luxury that almost no one could afford. Fortunately it is more often viewed as a by-product of normal activity by interested individuals.

A good estimate of maintenance costs is yet to be available due to the newness of the project. Stony Brook proposes to keep costs down by doing its own board swapping. The company is responsible for repair of faulty boards, as well as maintenance of the larger pieces of hardware. Clearly the susceptibility to damage of microcomputers is far greater than that of terminals, where the costly resources are in a protected environment. Individual component up-time is less important than in a large shared system.

While the environmental requirements of individual micros might appear to be small, it is easy to fall into a fallacy of composition in assessing the impact of a large number located in public sites. While only minimum needs for rehabilitation and environmental enhancement have been supported in the preparation of the sites on campus, the aggregate costs have been substantial. Obviously the multiplicity of sites is attractive to the end user, but significantly increased these costs.

Security is a major concern in the college environment. All the sites will be monitored during the entire time that they are open. Even relying substantially on student monitors, providing this supervision for the six sites totals a large sum on an annual basis. We expect, nonetheless, to incur a certain amount of theft and possibly vandalism.

Support is a major concern, particularly given the limited staffing available in the New York State environment. The Center expects to train the faculty and site monitors in the use of the systems. We will prepare general documentation and instructional materials. Consulting will be offered to courseware authors. Macros and templates will be developed to assist them. Even the staff costs shown do not represent overly generous support for a project of this magnitude.

Ultimately, of course, one attempts to learn from an undertaking such as the present one. While we are now only about half way through the project, it is perhaps not too early to offer a variety of observations and thoughts.

The first is obvious - everything will always take longer than your greatest expectation. We have just begun installing the first three sites with the hopes of going into genuine production with the coming semester. Fiscal constraints will delay the second three until the next academic year. Delays are to be expected in a developmental project, but the greatest frustration is how much time has been lost in carrying out ordinary transactions with the vendor and with the State. Judging by experience at other institutions, Stony Brook is not alone in this respect and much of the slowness might have occurred even in a more mundane undertaking.

Another conclusion is that nothing in computing is as cheap as you think, except perhaps iron. The exploding demand for computing of all flavors by virtually every member of the academic community has generated a voracious appetite for more resources in the support of computing despite the falling unit costs. The expectations of the State in this regard are completely unrealistic. Those of the consumers nearly as much so in the opposite direction. The introduction of truly innovative computing into the curriculum will only multiply these demands and increase demands on the budget.

One obvious lesson is that flexibility is essential. Perhaps the greatest virtue of Project SINC has been the ease with which hardware and software has been reconfigured. This is not without cost as the broader community is readily confused by the constant changes which have occurred, and support is clearly made more difficult. An adjunct finding is that multiple solutions are effective in addressing the diverse needs of an academic community; unfortunately, they are also more costly.

One paradox that we must learn to accept is that relatively low levels of equipment utilization are desirable. An obvious attraction of microcomputers is their ready availability and adaptability to the individual's demands over time and space. One must also recognize that even if we use the relatively low wages we pay students as a measure of the value of their time, they are worth far more than the computers at which they sit. Hence, the economy for which we should be striving is that of the overall educational process - a far more challenging and complex goal than minimizing the hourly cost of a CPU.

While formal organizational structures may be impressive on paper, it is key individuals who make an innovative project happen. In some respects, they have had to work just as hard as the vendor in selling their proposed solution both to the campus and the bureacracy.

A final obvious question with which I am often challenged is, whether I would do it over again if I knew all that I know now? The question may appear all the more poignant in view of the obvious, somewhat pessimistic cast of my remarks. The final answer, of course, must await the outcome of the project. The balanced response depends, on through whose eyes the relative successes and failures of the project are assessed.

To current students and faculty accumstomed to doing things in the traditional fashion, the answer is probably not. To the officials of the institution who expected a quick, low-cost solution to student needs, there Past come some disillusionment. To faculty who wanted a quick answer to better support for students with little effort on their part, the project must seem frustratingly slow and complex. To an understaffed computing center, which has been forced to address a whole new array of issues, while attempting to do business as usual, the project must sometimes appear to be an ego trip for the Director. Surely to the company which would like to make a profit by selling existing hardware and software, the undertaking must be both painful and costly. Nonetheless, I would ultimately give a qualified assent to my self-imposed question. It should be one of the goals of an academic institution to try to do things in a different fashion, even with the foreknowledge tha such projects will not always succeed as expected.

COST ELEMENTS

ITEM	AMOUNT	SOURCE
DEC Contract	$990,000	Hardware, basic software, initial maintenance
Site Rehabilitation	$165,000	Power and Air Conditioning
Furniture	$ 32,000	Tables, Chairs
Supplies	$15-30,000 annually	Paper and printer kits
Monitoring	$100-150,000 annually	Student workers and supervision
Added Software	$ 10,000's	Depends on packages selected
Center Support	$100,000 annually	Management, planning, installation
SIMC Staff	$ 90,000 annually	Consulting, programming
Hardware	$40,50,000 annually	On-going after project.

AN INTEGRATED COMPUTERIZED MANAGEMENT INFORMATION SYSTEM/ANTICIPATORY DECISION SUPPORT SYSTEM AT LANSING COMMUNITY COLLEGE

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At Lansing Community College an integrated and computerized management information system provides support to operational management, information for management decision making throughout the institution and the capability for providing information through a management decision support system. The College uses an integrated data base which has been developed from operational systems. The ICMIS/ADSS has been created to reflect the organizational structure and managerial style of the College. For organizational purposes the system at LCC has been developed using eight information files: Students, Instruction, Personnel, Finance, Facilities, Community, Research and Administration.

INTRODUCTION

This paper represents over 10 years of commitment by Lansing Community College to the development of a integrated and computerized management information system. The College's involvement in the use and application of computers as a means of streamlining major operations such as financial aid and student record keeping extends well beyond ten years. However the College has been actively committed to the development of an integrated and computerized management information system for the past ten years.

At LCC the implementation of an integrated system has been based upon intensive participation and planning from the operational, tactical and strategic management levels of the college. This approach has involved the College's top management team in planning sessions to set goals and priorities for the operational systems to be developed. It has also involved the operational users of the systems in intensive planning sessions directed at identifying user work flow and user information requirements.

In the evolution of the College's integrated MIS system it has been essential that the College's planning allow for the continued inclusion of the most up-to-date hardware and software technology as this technology has been developed. It has also been essential that the college's management style and organizational structure be recognized and reflected throughout the development of the system.

The MIS system which has been developed includes a capability of providing information for management decision support activity, a strategic planning capability and the integration of office automation /work station technologies.

The College has learned that the development of a total and College-wide system must provide flexibility for developments which will occur in the future. A general outline of some of those expected developments is included in the segment which addresses our plans for the future.

THE NEED FOR MANAGEMENT INFORMATION

The requirement that organizations monitor their operations to determine their success or failure has always existed. To accomplish this, organizations gather information to assess their progress, guide their daily activities, and plan their future course of action. However, organizations are increasingly confronted with demands for more and better information from both external and internal constituencies.

Externally these demands originate from state and federal agencies, potential sources of future funds, and future customers. As the pace and pressures of decision making and planning speeds up, internal demands for information have also increased. Within the organization, operational managers require more accurate and more timely information for use in making crucial day by day or hour by hour decisions. Tight financial situations, limited facilities and equipment, and greater demands for quality have increased the need for accurate information regarding the quality of a course or program or whether or not the program is remaining economically feasible.

One of the most important steps an organization can take is to gather and utilize accurate, timely and consistent information in its planning and decision making process. The information gathered by an organization and the way in which this information is used in the management and decision making process has a direct impact on the success or failure of the organization. A management information system which collects, organizes and summarizes pertinent information at all levels of the organization can be a major factor in this success.

THE MANAGERIAL PYRAMID

The traditional hierarchy of management is often represented by a managerial pyramid which contains three levels of management -- operational management, functional or tactical management, and executive or strategic management.

In the development of computer supported operational and management information systems, Lansing Community College has been committed to involvement throughout the organizational structure in the development of systems to increase effectiveness and enhance quality. This top to bottom involvement is essential since the detailed data required for operational management is often very different from the summarized and trend related data required for upper level management.

The development of an integrated computerized MIS and an anticipatory decision support system clearly parallels the traditional managerial pyramid. For example, the operational management level depends upon operational systems which gather and accumulate data for use in day to day transactions. Summary information is drawn from these operations and is used by functional managers at the mid-management level of the institution. Finally, highly summarized information, often on a longitudinal basis, is used by executive management for trend analysis, problem solving, and new program development. At the strategic level, the information can also be used in the framework of a decision support system, to support modeling, "what-if analysis" and strategic planning.

The ICMIS/ADSS system at Lansing Community College has been developed to take into consideration the needs of the entire management team, from operational "line" managers to top executive decision makers.

INTEGRATED OPERATIONAL SYSTEMS

The ICMIS/ADSS at Lansing Community College is based upon operational systems. These systems provide computerized support to the College operations. At LCC it is extremely important that the systems which serve operational management are also integrated in order to meet the management information needs of mid-level and upper-level managers. As a result, the great majority of the operational systems in place at LCC have been developed in-house, by College staff.

This approach has created two major advantages in the development of LCC's MIS system. The first major advantage is that the systems designed by the College have been able to reflect and embody the College's management style and organizational structure.

The College's organizational structure and management style have been based upon the belief that decisions should be made at the appropriate and lowest possible level, with an emphasis upon information as a vital factor in the decision making process. To implement this belief, the organizational structure of the College is highly decentralized and quite horizontal, with an emphasis on rapid response for service and program delivery. This structure and style has created high accountability at the operational level, flexibility and quick response by program directors, and a requirement for accurate information for decision making throughout the College.

The existence of extremely successful operational systems in such traditionally back- logged areas as student registration and records, financial aids, and general ledger accounting have been a crucial factor in maintaining the college's operational and management style.
The College's success in these areas has made it possible for a highly decentralized structure to operate without centralized systems and controls. Since the systems have been developed to support operations, the operational areas of the College have been able to maintain an expected level of service.

A second major advantage of in-house systems development has been that systems developers have been able to develop truly integrated systems by following an overall plan for systems development. This overall approach has helped the College avoid the fragmented, costly, and divisive hardware and software approach which can occur when systems development and computer hardware and software acquisition takes place on multiple fronts throughout the College. By following an integrated approach the appropriate linkages among systems have been established as each system was developed.

The commitment to integrated systems insures that all managers within the institution are working with a consistent set of information. This integration makes possible substantial efficiencies in gathering and maintaining data and information. For example, one data element may serve the information needs of several systems.

MANAGEMENT INFORMATION SYSTEM FILES

For organizational purposes, the ICMIS/ADSS system at LCC has been constructed around eight management information system "files."

These files serve LCC as a taxonomy which can be used to classify data and information. The eight files are: Students, Instruction, Personnel, Finance, Facilities, Community, Research, and Administration.

At LCC approximately 40 automated systems have been developed within the eight MIS files to support the academic and administrative functions of the College. Each functional area of the College does not use all 40 systems. In fact, the types of systems used and the specific functions available depends upon the purpose and function of the organizational unit. In many cases systems have been developed which support both administrative and academic functions, since data is integrated across the institution.

Students

The Student file contains systems which enable the College to register students, disburse and account for financial aid and maintain accurate academic records on over 22,000 students per term. The data collected in a number of the systems which make up the student file is used as basic information by systems in other files. In addition, the information serves as a foundation for planning, for specialized management reports and for analysis regarding future program development, enrollment patterns and student recruitment.

Instruction

The instruction file contains those systems which are used by the College to deliver instruction and to manage the instructional process for quality and results. In the development of the systems within the instruction file the College has made use of nationally recognized products to provide highly specialized support in the areas of computer integrated manufacturing and learning resources.

Finance

The systems which have been developed as part of the finance file address the financial operations of the College. Included are fully integrated systems which support accounting, purchasing and budget monitoring. Additional integration exists between finance file systems and student file systems in the areas of tuition, fees and financial aid. A micro-based budget development system allows for modeling and analysis of budget development alternatives as well as rapid budget development and revision.

Administration

The systems which make up the Administration file are used across the College to more effectively manage College operations. Included is longitudinal information on instruction, program history, instructional quality, and program cost. In addition the information contained in the systems within this file is a major component of the anticipatory decision support system at the College. The implementation of the electronic automated office at LCC, through word processing, electronic mail and electronic calendaring is included in this file.

Community

The community file contains those systems which provide information and support for the College's interrelationships with the community it serves. Included are systems which provide information concerning how events in the external community will affect the College. As one segment of the Community

Data File the College is linked with statewide and state maintained systems and data bases. These systems allow for interactive modeling of funding proposals through the use of a statewide data base.

Facilities

The facilities file includes those systems which contain information used in the management of the College's physical facilities and equipment. Detailed space utilization information is integrated with instructional data to provide facilities use information. Additional systems monitor and manage the College's energy conservation program and its equipment maintenance program and its fixed assets.

Personnel

The systems which constitute the personnel file have been developed by the College for the purposes of personnel administration. Included are a means of maintaining basic personnel information such as salary, benefits, job history and EEO/Affirmative Action data. Also included is an on-line system which supports the College's instructional divisions in processing over 1000 separate part-time instructional agreements each term.

Research

The research file maintains a substantial system of information which is gathered by regularly conducting surveys of the College constituencies. Included are students, faculty and staff, the community, local business and industry and other potential college service and program consumers.

ANTICIPATORY DECISION SUPPORT SYSTEM

An Anticipatory Decision Support System is the logical extension of ICMIS in a number of ways, since it allows the college's managers to use the longitudinal and summary data of the ICMIS in a decision support system context. Through integrated data bases and an electronic communication network, managers at all levels of the College have consistent data and tools to assist them in planning, analysis, and decision making.

At Lansing Community College the anticipatory decision support system provides assistance to managers in a number of ways; included is information for use in the short range and strategic planning process, financial ayalysis data, facility and program analysis data, program tracking information and specialized report generating capability. These functions are supported by mainframe driven presentation graphics software, and by a number of micro driven spreadsheet analysis and mainframe download programs.

Much of what makes up the development and use of the college's decision support system is clearly related to the process of analytical problem solving and the use of modeling and simulation in management decision making. Managerial skills and decision options are substantially enhanced by using a computer to assist in analysis, weigh alternatives, examine and project trends, and view information in a graphic format. The use of graph output as an analytical tool gives the manager the opportunity to recognize relationships in information, identify trends and project, simulate, or model, based upon what has occurred in the past. The use of graphics is particularly important at this level because of its value in depicting summary data.

At LCC the decision support component of the system provides data for analysis and assessment of the progress the College has made towards its objectives. Included if needed is on-line longitudinal information about program and course performance, including credit and cost history, evaluation, facility usage, and student objectives for enrollment in the program. The system also provides information to further identify trends or situations which call for strategic planning activity. These questions, and their answers, allow for anticipation, planning and decision making, which is supported by sound information.

MICROCOMPUTER SUPPORT

The increase in the number of and power of microcomputers has had a direct impact upon the college's ICMIS/ADSS. As the number of micros increases, it is a frequent occurrence for an institution to be faced with discrete and highly personalized operational data bases which serve legitimate needs. Often these data bases cannot be integrated for college-wide use when necessary. To emphasize the need for an overall integrated data base systems approach, the college has implemented and staffed an information center to deal with the large number of microcomputers being used on campus. The information center has established standards for micro hardware and software acquisition and microcomputer programming support.

The decision support system capability of the college has also been strengthened as a result of the use of microcomputers in uploading and downloading information from the mainframe to the interactive modeling and analysis power of the micro. Micro software packages such as Lotus 1-2-3 are now being used to further develop "what if" questions, make projections and assist in the analysis of data.

In addition to the DSS support provided by the micro, the micro has been identified as the pathway for the College's implementation of multi-task work station technology. This effort has begun with the installation of twelve IBM PCs which have the capability to serve as dumb terminals, communicate with the mainframe, utilize Displaywriter II software, and provide micro based computer power for spreadsheet and other decision support software. These PC/terminals have been installed at the upper management level of the organization to provide support to office operations and electronic office software.

ICMIS/ADSS - HARDWARE & SOFTWARE

This ICMIS/ADSS at LCC has been planned and developed over the past 10 years to assist in managing resources, streamlining operations, and in strengthening the decision-making process at the College. The eight data files which make up the overall system are integrated through a mainframe supported data base management software system. Within the 8 MIS files are over 40 highly effective computerized operational systems which provide accurate, consistent, and reliable longitudinal data for management, assessment and strategic planning.

The College's ICMIS/ADSS system is supported by a college-wide network of computer hardware. Included are an IBM 3083 mainframe, with 150 terminals to support administrative and academic data processing. Attached to the mainframe are fifteen CAD/CAM and CMC devices which are used for the delivery of academic programs in computer integrated manufacturing. A Digital VAX 11/780 minicomputer and 70 devices are used for faculty CAI and CMI development. The college's three Learning Resource centers as well as the Lansing Public Library are supported by a turnkey library circulation and cataloging system which is composed of 30 devices and a mini-computer located on the LCC compus. The library system is linked to the On-line College Library Catalog (OCLC) system which provides cataloging and interlibrary loan capability through over 3000 libraries nationally.

A Digital 11/44 minicomputer which supports 48 devices is used in a college-wide word processing system. The college's efforts in implementing work station technology are reflected in twelve multi-tasking IBM PC workstations which provide word processing, micro-mainframe interaction and PC spreadsheet capability.

Further hardware and software support is available to certain offices through IBM PCXTs which are directly linked to the mainframe. The PCs provide micro-computer power through widely used software such as Lotus 1-2-3 as well as uploading and downloading capability from the mainframe.

FUTURE PLANS

Future planning for ICMIS/ADSS at Lansing Community College must take into consideration continuing demand for new and innovative large scale computerized systems to support traditionally labor intensive operations such as student advising. Future planning must also alloccate resources for the ongoing maintenance and revision of the College's existing systems.

At Lansing Community college the nature of computerized support is rapidly changing. Workstation technology, the electronic office and user developed microcomputer applications require different kinds of expertise and resources. Further, future planning must make allowance for rapidly expanding computer applications in areas such as data base access by public subscribers, delivery of instruction through an integration of computing and cable television, and the delivery of other services on either a community or global basis.

Electronically Interconnected Community

A major goal of Lansing Community College is to electronically tie together the College and the community it serves. These electronic linkages and networks will connect the College with students in their homes in an on-line instructional environment; these linkages will also provide networks for use by local businesses and industries as they tap into the resources of the College in a fee for services arrangement.

The electronic linkages between the College and the community are presently being used to more conveniently deliver services between the community to the College. Electronic transmissions of materials for volume printing and peak load energy monitoring with local utilities are just two examples of these community/college networks.

Instructional Delivery

In the instructional area the College is developing specific linkages which will include cable TV instructional telecourses complemented with computer assisted instructional support and on-line, in-home computer hook-ups for instructional delivery.

The on-line system now available allows a student in the community to "dial-up" access to the College's mainframe computer. This dial-up is accomplished through a micro-computer and modem in the student's home and "Music", a time sharing instructional system on the College mainframe. Through the "Music" system a student can connect with an interactive capability and complete assignments in the data processing/computer programming courses offered by the College. This community based access allows the student to complete assignments at home, when convenient for the student. The need to come to the campus at a specified time to compete for parking and laboratory space is reduced. These linkages can be used in the delivery of regularly scheduled instruction and in the delivery of specialized and tailor-made fee-for-services programs for business and industry.

Business and Industry Linkage

Businesses which wish to draw directly on the resources provided by LCC will be able to do so in a number of ways. Access to the LCC Learning Resource Center card catalog is now available to any micorcomputer owner with a modem who wishes to dial up the College and "page" through the library holdings. Linkages are being developed between the College's Learning Resource Center, its Management Development Center, and local business and industry so that the on-line data base search capability can be made available. The data base search capability involves trained staff in the application of computerized data base search techniques to obtain highly specialized information for businesses and industries. Specialized data bases can be accessed and searched and further information resources can be obtained and organized on request through the capability of the on-line computer library consortium (OCLC), a computerized network of over 2200 libraries across the United States.

The College-community interlink in computerized systems is also rapidly expanding. The College has begun to provide certain computer services on a fee basis and has also moved into a fee for services arrangment regarding current information which is available through the highly specialized on-line data bases. Further plans include accessability to the College's on-line instructional support systems in the technical area of computer integrated manufacturing. Access to these services will be provided on location within a local business or industry.

Work Station Technology

The creation of multi-task work station technologies has begun to impact equipment decisions, staffing patterns and management styles at the College. Rather than replace aging terminals with newer models, multiple function personal computers are often selected. These devices can connect directly to the mainframe and serve as a terminal; they can stand alone as a personal computer and run spread sheet and decision support software; they can upload and download information from the mainframe for analysis and simulation; they can serve in carrying electronic mail and messages as well as electronic calendars; they can also serve as either a stand-alone or networked word processors. These multiple functions are now being implemented on a limited basis in key administrative offices.

It is expected that the use of PCs will increase significantly both as replacement terminals and as a new means of bringing information from the ICMIS/ADSS system to the Colleges managers. The implementation of this equipment will increase the College-wide ease of access to the information within the College systems.

CONCLUSION

The ICMIS/ADSS system which has been developed by LCC is a highly effective integrated system which has provided the College with a way to maintain its institutional quality and level of services in a time of severe budget cutbacks.

Future emphasis will focus upon the creation of appropriate training and education in order that greater numbers of the College's mid and upper level managers are able to effectively use the information provided by the system. As the volume and accuracy of information increases and as the sophistication of information tools increases, the need for assistance and direction will increase. The growing emphasis on netowrking, workstation technology and the changing nature of managerial responsibilities will increase the pressure on the system to provide more and better information to a larger number of decision makers.

Although the total system is not now and may not ever by fully complete the ICMIS/ADSS has enabled the College to continue to operate with an organizational structure and management style designed to provide highly flexible and cost effective services to its community. In the future these demands for increased quality and timeliness in an extremely competitive marketplace are expected to grow. The information provided within the system will be a vital component in how the College meets these challenges.

SELECTING MICROCOMPUTER NETWORK CONFIGURATIONS - A MODEL FOR TECHNOLOGICAL ENDURANCE -

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Microcomputer networks are becoming fairly common throughout higher education in both administrative and instructional settings. These networks are usually developed to satisfy a specific need such as office automation with file sharing within an office or building, or for instructional settings where a common software source will be shared.

Funding limitations dictate that these newly introduced networks will probably be around for a long time. Unfortunately, selection criteria for the networks is often limited to statements such as "it was the only one handled by our local vendor;" or, "a colleague spoke highly of this one."

In this paper, we attempt to establish a simple but workable approach to a process of network selection which will identify specific needs, and suggest solutions with maximum flexibility so as to avoid technological obsolescence in the short run. The specific topics covered are:

1. Specifying functional needs for a network design
2. Prioritizing and weighing functional needs
3. A look to the future - alternative directions
4. The network selection process

CHAPTER 1

SPECIFYING FUNCTIONAL NEEDS FOR A NETWORK DESIGN

EVALUATING WHETHER OR NOT A NETWORK IS APPROPRIATE

Although microcomputer networks are becoming fairly common, educators facing a decision about microcomputer configurations for instructional support or administrative purposes are often hesitant to get into networking, mainly due to "fear of the unknown" or confusion about which alternative solutions fit which specific sets of user requirements. The first evidence that something other than "stand-alone" configurations may be needed is usually the obvious redundancy of peripheral hardware necessary when a number of users of microcomputers occupy the same general work space. Each machine requires a printer, sometimes both a dot matrix and a daisy wheel type printer, each machine may require a hard disk, and several exotic devices such as plotters, optical readers, and color printers may be needed by one or more users.

Software usage patterns often provide another early symptom that something may be amiss. A classroom full of students learning a specific word processing package will require one copy of the software per student. Moreover, damage to diskettes and to disk drives resulting from the improper handling of diskettes by students may cause excessive machine down time. In another instance, several users who are working on a common document find it difficult to organize and merge text which was created on several independent machines.

Another indication of the need for a approach different from stand-alone computing arises from security related problems. Certain data needs to be protected from certain categories of user, and certain data must be guarded and properly backed up so that recovery is assured in case of accidental data loss or data loss related to equipment or power failure. Setting up procedures for a group of stand-alone microcomputers which are tight enough to preclude excessive risk of data loss is difficult if not impossible, and such procedures rely heavily on staff procedures which are especially vulnerable to turnover and absenteeism.

A more technically sophisticated category of need which might imply a network is that multiple microcomputer users may have a need to communicate with another micro, mini, or mainframe computer via a network (async, bisync, SNA, etc.) or via other carriers (telephone, private exchanges, etc.). In these cases, each microcomputer may be equipped to double as a terminal on an existing network and/or connected via modem to a external communications carrier, or the need may be addressed by establishing a microcomputer network and employing a gateway device approach.

The point at which a microcomputer network becomes cost-effective depends upon actual cost comparisons and the intrinsic value of being "technically correct". Actual cost comparisons are fairly easy to arrive at, less tangible aspects of environment such as the value of being "on the leading edge of technology" must be assessed or quantified by the person making the purchase decision.

EXAMINING AND SPECIFYING FUNCTIONAL REQUIREMENTS

The decision about whether or not a network is feasible should be based on factors such as those examined in the previous section. Total costs of peripherals (printers, hard disks, terminal emulation boards, modems, etc.) can be compared with various available network solutions, and when added to the less tangible costs (training time, probable storage medium problems, technological "profile", etc.) a fairly objective decision can be reached. Once this is done and if a network appears to provide a feasible solution, network planning should begin. Factors to be examined in the planning phase include:

PHYSICAL ISSUES	Physical layout of user stations Existing cable layout and adaptability to network Physical constraints to introduction of new cable Physical distance maximums Types of microcomputers to be included in network Types of peripherals to be included in network (specific)
SOFTWARE ISSUES	The specific application software to be used The nature of storage access requirements (read-only, I/O, multiple user file update, etc.) Security Requirements - Security levels (department, user, file, data element, etc.)
PROCEDURAL ISSUES	Amount of mass storage demanded by user and application Local (at work station) storage requirements Is stand-alone capability important? Boot (start) system via diskette or automatically? How many users (concurrent sessions) must access another network at one time? How many users (concurrent sessions) must be able to access public or private exchange (via modem) networks at one time?

These represent the majority of categories of information which you will need to begin network planning. For simple networks many of these categories will be "no response" or "no need". For more complex network requirements each of the items must be carefully assessed, with information gathered and assembled in some manner which allows for a comprehensive set of guidelines for decision making. One method of gathering data in a uniform manner is suggested later in the paper.

A DISCUSSION OF THE ISSUES

PHYSICAL ISSUES - The physical issues relate to the number of potential network users, the types of devices intended for inclusion in the network, and the layout of the facility(s) in which the network is to be located.

All networks have a physical limitation on the number of member stations which can reside on the network. This number ranges from as few as six to hundreds of member stations. The fact that a certain network boasts a high number of potential member stations may be less important than performance specifications which will indicate how well the network performs under certain types of workloads. There are a number of sources for information on performance, and general guidelines are offered in this paper. Perhaps the best guide to network performance is to talk to the users of an existing network which is used for a purpose similar to the one planned for the network under consideration.

Cabling requirements are always a difficult consideration when planning a network. Certain networks require coaxial cable of specific ohm rating, while others require twisted pair cable which is the same (two or four wire) as the cable used for the standard telephone system. In some cases existing twisted pair cable may be usable for a new network, but distance constraints and switching connections usually mandate that new cable is strung. Stringing cable is expensive, especially because building codes and appearance are key elements in the design. The best solution is to plan for all near term (2-5 year) communications needs and then try to select a network which uses cable that can support all of the identified communications needs. This reduces future costs, but fitting all needs into one cable characteristic is difficult with current technology. Fiber optics promise to solve the difficulty, and when combined with digital switching PABX units this technology promises true universality. There are solutions which when combined with adequate planning will provide maximum future flexibility through layered network typology.

The constraint of distance is often a limiting factor when planning cable layouts. The most common networks have distance limits of less than 1/2 mile. Some networks have signal boosters which can increase the distance limit, but excessive distance brings other inherent problems such as vulnerability to noise.

A determination must be made regarding the types of computers, peripheral devices, and external communications accesses that will be included within the network. Each different type of computer which is to be connected to the network may require a different network protocol board. It is important to ascertain which computers a certain network manufacturer supports, and which it plans to support. The larger, more stable network manufacturers can be counted on to support a wider range of computers and devices than the newer smaller manufacturers. In addition, the product line directions which are already supported by a manufacturer will give the buyer a clue as to future direction. Additionally, the operating system software which the network supports will dictate which mass storage devices will work with the network, and how easily the network may support multi-user applications. These specific technical issues will be dealt with in detail later in the paper.

SOFTWARE ISSUES - It is important to plan in advance which applications software you expect to use with the network for several reasons. First, depending upon which operating system the network uses your choice of software for a certain application may be limited. Secondly, some software vendors will negotiate network discounts which are very beneficial when compared to stand alone software prices while others will require a license fee for every station on the network.

Perhaps of greater importance is the nature of the intended application. If multi-user access to data is intended (more than one user reading and writing to a data set at one time) it is important to select a network which supports software designed for that purpose. Some software utilizes "file locking" which means that only one user can access a file at a time, while some utilizes record locking, some utilizes data element locking, and some offers no locking capability at all. The type selected will depend upon how many users will be accessing which class or classes of data simultaneously. For instance, if a warehousing application is planned, in which a number of users will be updating incoming and outgoing material at the same time, file locking would be prohibitively slow, and record or data element locking, or some other scheme of insuring accurate updating would be called for. For an application in which an individual record may be updated by a number of users (name change, charges, etc.) it is less likely that two users would be updating the same record at the same time, so record locking might be appropriate. In yet another instance, a group of word processing operators may have work assigned in a way which precludes two or more of them working on one document at the same time, so file locking would be satisfactory for the application. Security requirements are as complex as data sharing considerations, and must be analyzed with similar care. Clear definition of the data requirements in the planning stage will preclude selection of a network which cannot support the intended application(s).

PROCEDURAL ISSUES - Exactly how the network will be used involves analyzing several procedural issues. Networks usually require that a member station identify itself as active to the network host (often called server). This is usually done by starting the member station with a program which is stored on a diskette supplied by the network vendor (called a "bootstrap" or "boot" diskette). For instructional and some administrative applications this will prove cumbersome, because the boot diskettes must be used each time a station is turned on or off, and students may lose or damage the diskettes. Many networks offer solid state option chips which replace the boot diskette, and start the member stations automatically when the power is turned on.

It is also of importance to determine how often if at all the members will be used as independent computers which are not part of the network. How difficult it is to use the computer without network services should be assessed, and a close look at the quality of the documentation which explains how all of this is accomplished by the user will help in the network choice.

Another software/hardware consideration is the extent to which users will require access to another computer network (usually a mainframe host network) or an external communications device such as a modem. Some networks allow several or all users to access a single gateway for communications purposes, while others do not. It is also important to determine what additional hardware and/or software will be necessary to make member stations behave like certain computer terminals (VT 100, 3278-9, etc.), and whether or not the hardware board if required is compatible with the network board in the same member station. Pay close attention to the specification of ALL characteristic physical, software, and procedural issues when planning a network. The method of linking the identified characteristics to a single or narrow choice of networks will be the subject of chapter five.

LOOKING AHEAD TO FUTURE NEEDS

The near future (1-3 years) will surely bring some changes in your needs, and some rather dramatic changes in the technology and price of networks. Making a move today need not lock out the possibility of taking advantage of the future offerings, but care should be taken to look ahead and plan a network with future flexibility in mind.

Simple networks which are designed for a single purpose (CAD/CAM instruction for example) may be based on a fixed set of peripheral devices and a fixed set of software which you feel will not change during the useful life of the network. In addition, you may be fairly certain that another set of users will not want to share in the use of the network in the future. These sort of givens make planning for future changes a minimal problem. For most networks being planned however, future needs in terms of peripheral devices to be added or software demands are not well defined. In these cases it is possible to at least establish probable direction, and that will allow the planner to accommodate some of the probable demands of the future.

The more critical future needs which can be assessed to a degree in advance include:

What is the upper limit of the number users who would logically (from a standpoint of data sharing and physical location) be added to the network?

What new applications might be added to the network?

How much physical device flexibility will be necessary?

What future communications requirements might be placed on the network?

Answers to these questions will help in the determination of a network configuration. Naturally, there is a positive relationship between the flexibility and upwards compatibility of a network and network cost, but the factors of cost and flexibility should be balanced to accommodate the specific installation to the highest degree possible.

CHAPTER 2

PRIORITIZING AND WEIGHING FUNCTIONAL NEEDS

WHY IT IS IMPORTANT TO SPECIFY NEEDS AND ALLOCATE RELATIVE WEIGHTS TO THOSE NEEDS

The section dealing with functional requirements listed most of the needs typical of a network which would be used for instructional or administrative purposes. You will find that some of your needs are clear and definite, and others are less well defined. Some criteria may be of utmost importance while others could be classified as "nice to have if possible." At the end of the network definition process the requirements/needs will have to summarized and evaluated in a way which will denote which specific network solutions will be the most effective. To accomplish this to a satisfactory degree of precision it is necessary to apply weights to the requirements/needs.

IDENTIFYING TRADE-OFFS, MINIMIZING POTENTIAL NETWORK CONFLICTS

The purpose of the process being suggested in this paper is to guide the network planner through the steps of requirement analysis and network selection in a way that will preclude the planner from ending up with a network that cannot satisfy the intended purpose, or from spending unnecessary amounts of money for a network which has features and flexibilities which are not required.

Network conflicts are most likely to result from situations such as:

Network size far exceeding the original plan
A requirement to connect a non-compatible device
  to a network (a new type of laser printer, etc.)
A need to tie a LAN into an existing or a new mini
  or mainframe computer network
A need to provide file sharing with some new software
A need to connect services (electronic mail, etc.)
  between two networks of different manufacture

Some future requirements/needs cannot be foreseen, but awareness of the potential problem areas, and a process of involving key users with network planning can prevent the installation of an inadequate network which must be totally replaced at a later date. In order to deal with the magnitude of issues surrounding a network decision, it is suggested that you begin by establishing a simple two-dimensional matrix with the requirements/needs on one axis and the relative weights along the other. The following matrix is an example of an actual network matrix for an instructional application which was intended to serve an accounting lab of approximately 40 students.

	ISSUE	DESCRIPTION	RESOLUTION REQUIRED?	PRIORITY
PHYSICAL ISSUES	PHYSICAL LAYOUT	Does the planned network's layout favor any network type?	N	-
	EXISTING CABLE	Is there existing cable which could be used for the network?	N	-
	PHYSICAL CONSTRAINTS	Are there physical constraints which prevent use of any specific cable?	N	-
	PHYSICAL DISTANCE	Does the distance to be covered by the network prevent use of any specific network?	N	-
	TYPES OF MICROCOMPUTERS	IBM PC compatible and DEC and XEROX	Y	1
	TYPES OF PERIPHERALS	Must have print spooler and support XEROX laser printers (or equivalent)	Y	1
SOFTWARE ISSUES	APPLICATION SOFTWARE	Must support MS-DOS	Y	1
	STORAGE ACCESS	Requirement for Read-only	N	-
	SECURITY REQUIREMENTS	Must have password facility and have file level access security	Y	1
PROCEDURAL ISSUES	MASS STORAGE	10 MB initial - expandable to 100 MB	Y	2
	LOCAL STORAGE	At least 360 KB floppy	Y	1
	STAND-ALONE	Must function as stand-alone unit and run different operating systems without physically detachment from network	Y	1
	BOOT OFF ROM	Must be able to boot without using a boot diskette at workstations	Y	1
	CONCURRENT NETWORK USERS	Must allow 40 concurrent users to access bysync network in 3278 look-alike	Y	1

DISCUSSION OF THE MATRIX - The matrix illustrated here is meant to guide the network planner through the process of identifying the issues which will require resolution during the process of selecting the specific network to be acquired. The issues listed are the most common ones encountered, although additional issues may become important for more complex networks. The issues are really the operational specifications for the network in graphic form. The resolution of the issues will involve matching each of the issues for resolution with a particular type of network, thus following a process of elimination. The magnitude of priority is to soften the process, in cases where every network type is being eliminated, or cost limitations must mitigate the resolution process.

The network being specified in the matrix is a simple, one dimensional network (from a standpoint of usage characteristics) which will be used for instructional purposes only. It is intended primarily for use in an EDP/accounting laboratory, and must run software for accounting case studies, word processing (specifically Display Write II and WordStar), Basic, Pascal, Fortran, Cobol, and each workstation must double as an IBM 3278 terminal for use with an IBM mainframe computer using a bysyncronous network. No cable exists in the room now, and the only constraint is that it must be easy to add units to the cabling once it is installed.

It is very important that students be able to start the workstation without a boot diskette, because the lab will not be staffed at all hours and the boot diskettes would not always be available. Students will keep their own work on floppy disks so each unit must have a disk drive. At times UNIX will be used on individual machines, so it must be easy to use the work station as a stand-alone computer without having to disconnect the unit physically from the network. Passwords will be assigned, and security must be offered at the file level, especially since some faculty will use the network and mass storage unit for their personal workfiles.

Computers to be initially used on the network include IBM PC/ATs, IBM PC and PC XTs, DEC Rainbow and Rainbow 100, and the XEROX personal computer. A central high speed dot matrix line printer will be used with a print spooler, and a laser printer will be added as a network addressable station for special output.

In order to match the issues for resolution with the appropriate network it is necessary to know about network characteristics in general, and then to know about specific manufacturer's networks which fit within the general characteristics. Chapters 3 provides general information about network characteristics. Chapter 4 will focus on the process of making the final network selection decision.

CHAPTER 3

THE BASIC ALTERNATIVE DIRECTIONS

BASIC NETWORK TECHNICAL ISSUES

When reading about microcomputer networks or dealing with vendors the same buzz words keep coming up over and over again to describe the network and how it works. Local Area Networks (LANs) provide by definition a distributed control strategy for the various member stations in the network. Distributed control means that each member station can independently establish access to the network by an accepted set of rules. This is opposed to centralized control in which access to the network is controlled by one member or master station. A very common LAN is called Ethernet. It is described as being a bus based, contention access, baseband LAN implemented using coaxial cable. The purpose of this chapter is to clarify what this all means and establish the basic advantages and disadvantages associated with the major LAN technical issues.

NETWORK TOPOLOGIES

A network topology is the arrangement of the physical communication paths between the member stations of the network. Any topology can be created by using a series of point-to-point connections where only two member stations are linked to each other by a single line or a multipoint arrangement where many member stations share a single line. The most common topologies used by LANs today are either ring or bus in nature.

A ring topology is a point-to-point arrangement of member stations such that an unbroken circular loop or daisychain of stations exist. Each station must be able to recognize its own address so it knows if a message is meant for it or for some other station. If a message does not belong to a station it must also be able to repeat the message to the next member station in the chain. Ring networks are attractive because of their simplicity and ease of growth. The major disadvantage of a ring network is its reliability. The malfunction of a member station will bring the entire network down, therefore it is usually necessary to provide some sort of bypass capability into the network which can tend to negate some of its advantages.

A bus topology is a multipoint arrangement of member stations. Each of the stations is connected to a single physical cable via taps or connectors. Each member station must also be able to recognize its own address but does not need the ability to repeat a message that it receives because every station is connected directly to the same physical channel. This type of topology is very resistant to any single failure of a member station because each individual station is tapped into the bus and all stations can receive the same message at the same time. The bus structure is also very flexible allowing easy addition of stations or moving of stations in the network. The only disadvantage is in the greater difficulty in locating and isolating network problems.

NETWORK ACCESS PROTOCOL

Network access protocol describes the manner in which the member stations in a network can gain access to the network channel in order to communicate with other stations. It can be thought of as the Roberts Rules of Order of the network world or just simply traffic control. The two major access methods commonly used by LANs are token passing and contention strategies.

Token passing is a method in which a special message (the token) constantly circles the network from station to station indicating that the communications channel is clear. To send a message, the member station must grab the token and transmit the data it wants to send. No other station can send a message unless it has possession of the token. Once the station with the token has transmitted and verified its message was received or a certain amount of time has passed the station puts the token back in circulation. In this way network traffic is controlled because only one member station can talk at a time. Token passing can be used on both ring and bus network topologies. Using this access method it is very easy to expand the number of member stations in the network without serious performance problems. The time it takes for a message to navigate the network can be quite predictable making this method useful for real time applications. The major disadvantage is that care must be taken that the token does not get lost. Various schemes to do this can add an extra layer of complexity to the network.

The most common contention strategy is carrier sense multiple access collision detect (CSMA/CD). This method relies on each station that wishes to transmit a message to first listen to the channel to see if it is clear. If the line is clear a station will proceed to transmit its message and then listen to the message it just sent. If two stations attempt to transmit at about the same time they will detect a garbled message (a collision). The affected stations will cut short their transmissions and wait a random period of time before attempting retransmission. This technique is used exclusively on bus topologies. Contention is a simpler strategy to implement and thus also provides greater flexibility. The major disadvantage is that as more member station are linked into the network the chance of transmission collision will rise, and the more collisions that occur the more the network performance degrades. This is why you will find many contention systems implemented on a transmission media with very high transmission rates to help avoid this problem.

BANDWIDTH

The term bandwidth is used to describe the networks ability to move data between member stations as well as the range of analog signals that can be carried by a physical medium. Most of the current LANs on the market transmit their data using a baseband or a broadband technique.

Baseband transmission is where data is sent at its original frequency. The transmission can be either digital (on or off signal) or analog (continuous wavelike signals). The transmission of data uses up the entire data channel much like water in a hose. Data can be sent up to the full capacity of the physical transmission media being used, and only one type of message can be sent at a time. This is a very simple, fast and inexpensive form of transmission. It can however do only one thing at a time, and therefore creates a problem if you would like to send data and voice over your network at the same time over a single physical line.

Broadband transmission is where many different types of signals are sent over a physical medium at the same time. The capacity of the transmission media being used is broken into many different logical channels so data, voice, TV and other signals can be all sent together at the same time. Broadband is an analog form of communication where each message group is sent at a different frequency much like having a multi-lane freeway with each lane with a specific designation. Using the freeway analogy we would have one lane reserved for buses, another for trucks, and still another for cars. If the freeway needs to go both to and from the city, we would have six lanes, one for each vehicle type going to the city, and one for each vehicle type going away from the city. Because the traffic is broken up into many small designated lanes we can not get quite as many cars through in a particular time frame as if we were to use all six lanes just for cars. The added service diversity provided by a broadband LAN comes at a substantial increase of cost and complexity.

TRANSMISSION MEDIA

Transmission Media is the physical channel used to interconnect member stations in a network. Most LANs in use are designed to communicate over twisted pair wire or coaxial cable. The geographical limitations found on LANs are most often the result of the transmission media selected.

Twisted pair wire is the wire type most often found and is used in telephone communications. The wire is usually made of copper and are twisted together into wire pairs to help reduce electrical interference. Twisted pair wiring is used for low speed transmission. Transmission speeds can be as high a 10 million bits per second (Mbps) but most current LANs transmit at speeds of 1 Mbps or less. Twisted pair is relatively low in cost and is typically pre-installed in office buildings. It is the most cost effective choice for single building, low traffic requirements. The major disadvantages of using twisted pair is that is is very prone to electrical interference from adjacent wires and from external sources such as fluorescent lighting and heavy electrical loads, and is also limited to low baseband transmission speeds.

Coaxial cable is the main form of media used by the cable TV industry and is also used by the telephone industry primarily for long distance calls. Coaxial cable consists of a central carrier wire, insulation and an outer mesh. It can accommodate either baseband or broadband transmission. Data transmission speeds of 20 to 50 Mbps can be achieved, with most LANs typically in the range of one to 10 Mbps. Coaxial cable is fairly resistant to outside electrical interference thus having a low error rate. Many type of taps, connectors and repeaters are available which makes it very easy to branch or extend the cable to interconnect work stations. Coaxial cable has become the most common transmission media for LANs because of its large capacity, low error rate and flexibility. It is well suited for both indoor and outdoor environments, therefore inter-building and even intra-campus networks can be supported. The major disadvantages are that it is much more expensive than twisted pair and is often difficult to wire an already existing building with cable.

SUMMARY OF TECHNICAL ADVANTAGES

There are trade offs for each of the major technical issues presented. Other technical issues such as ease of installation, ease of use, file access capabilities, network security, and limitations on number of work stations, peripherals and users are currently vendor dependent. The following represents a summary of the major LAN technical issues:

ISSUE	CHOICE	COST	FLEXIBILITY	CAPACITY	GROWTH
Topology	Ring				X
	Bus	X	X	X	
Protocol	Token			X	X
	Collision	X	X		
Bandwidth	Baseband	X	X		
	Broadband			X	X
Media	Twisted pair	X			
	Coaxial cable		X	X	X

[This table adapted from Communications and Networking for the IBM PC by Larry E. Jordan and Bruce Churchill, Robert J. Brady Company, 1983, page 118.]

CURRENT DIRECTIONS OF NETWORK DESIGN

The microcomputer industry has a history of standardization through commercial dominance. It is therefore important to assess where the industry currently is in terms of microcomputer networking before we look to the near future. If we want to get the most for the money that we invest, it is important to ave the maximum flexibility in the different types of hardware and software which we can use both now and in the future. Investing in a network architecture that is 'state of the art' may be a dead end if there is little in the way of software to use, compatible hardware or peripherals available.

Currently the de facto microcomputer standard is the IBM Personal Computer and its compatibles. The majority of application software that is available is now being developed to run under Microsofts MS-DOS operating system. In the area of educational software, Apple DOS is still the leader but is being rapidly overtaken by MS-DOS applications. Local Area Networks are the primary means being used to network microcomputers. Of all the different types of LANs being used, baseband, bus based contention systems are the most common. The promotion of Ethernet by Xerox, AT&T and DEC and its issue of Ethernet licenses to over 200 other companies is a significant factor in the battle for the LAN marketplace. It seems to be a toss up on the use of twisted pair wire verses coaxial cable, but coaxial based broadband systems are beginning to gain momentum. The most recent announcement of IBMs new PC network, a broadband, bus based, contention system using coaxial cable, reinforces the current trends in microcomputer LANs.

It might seem that the current trends in microcomputer networking give us a good indication on which way to proceed in our network selection to achieve the most flexible and durable result. Unfortunately, this is not the case. Each vendor's network hardware and software is generally incompatible with what the other vendors have to offer.

FUTURE DIRECTIONS OF NETWORK DESIGN

There are currently a number of official bodies looking at standards issues regarding networks but it seems unlikely that any one standard will be adopted universally. The IEEE Standards Project 802 was established by the IEEE Computer Society to look into this issue and ended up recommending three different standards. A bus based contention system (CSMA/CD) using either baseband or broadband coaxial cable (IEEE Standard 802.3); A bus based token passing system using either baseband or broadband coaxial cable (IEEE Standard 802.4); and lastly a ring based token passing system using baseband twisted pair wire or baseband coaxial cable (IEEE Standard 802.5. To make issues more complicated, future trends will give rise to more options.

The future trends in microcomputer technology will possibly give rise to the 32 bit UNIX based work station. UNIX is a computer operating system developed at Bell Laboratories, and offers power and flexibility for multiuser network environments. In the area of microcomputer networks there should be a trend towards more centralized network strategies through more microcomputer work stations being used on mainframe computers (i.e. IBMs 3270 PC) as well as the rise of the Digital Private Automatic Branch Exchange (PABX or CBX). Optical fiber promises to be a major supplement to both twisted pair and coaxial cable private networks in the decade ahead.

Digital PABX or CBX units are in essence centralized digital switching devices intended to handle a wide variety of local networking requirements including voice and data transmission. It is typically limited to 56 kb transmission rates, which limits the number of users which can be supported on one channel at decent response rates. This speed (using twisted pair cable) will be increased to 256 kb or higher in the next few years which will make the technology much more appealing for office automation and local area network applications.

Optical fiber technology uses fibers of plastic or glass and offers tremendous transmission speed and little vulnerability to interference. Splicing and connecting devices to optical fiber is very expensive today, but the costs are expected to become reasonable and competitive in the near future. When coupled with the PABX or CBX technology, optical fiber will likely open new alternatives for networking technology with a wide dispersion of applications and cost effective solutions.

BRIDGES AND GATEWAYS - ALTERNATIVES TO UNIVERSAL DESIGN

As we can see the issues and choices surrounding the networking of microcomputers will become more and more complex. It seems that no matter what we do our network will not be able to be all things to all people or provide adequate flexibility to take advantage of new technology. Internetworking through the use of gateways can offer a solution to the problems caused by conflicting functional network needs. In many cases an organization may have more than one type of network at a given site to satisfy a variety of needs. The organization may also have networks at various sights and may need them to be interconnected for information exchange or central control. There may also be a need to connect to other outside computer resources.

THE BRIDGE - The simplest kind of connection between networks is called a bridge. A bridge is used to connect two similar networks so they may communicate to each other. An example of this would be where two separate Ethernet networks are connected together.

THE GATEWAY - The gateway provides a solution for the more difficult problem of connecting dissimilar networks together. The term internetworking is used to describe this situation. The gateway provides any type of protocol conversion that is necessary for the two networks to communicate. The most common types of gateways found for microcomputer networks allow you to use the micro as a terminal tied to an external network or to a mainframe computer. Because "universal gateways" are impractical due to the different message sending protocols used by unique manufacturers it is very important that you determine whether or not a gateway exists to connect the two or more networks with which you plan to work. Future product announcements are fairly reliable from some vendors, but must be viewed with extreme caution if the connection is to be a critical requirement for the network. Enough gateways exist on the marketplace today to provide a decent range of choice during the selection process.

STEPS TO A SOLUTION

So far the paper has detailed the areas of concern when establishing specifications, and suggested a general process for quantifying the overall specification in a simple matrix. General network characteristics were then discussed, so that a framework could be developed for matching the identified specifications with available technology. The next steps are to detail and refine the selection process so that a final decision can be made. The specific final steps are:

1) Carefully define current and future network functional requirements (prepare the matrix for your network)

2) Define the current and possible future relationship between the network being developed and other networks

3) Select the general network model (bus contention, token passing, broadband, etc.) which best fits the greatest number of functional needs and concurrently provides the maximum flexibility for a variety of peripheral equipment and software

4) Study each vendor's offerings of the network model type which you have selected. Don't confuse the issue by considering network types outside of the general network model which the process has led you to.

5) Match the final selection with a bridge or gateway if communication with another network was specified. Be sure to ascertain whether transmission speed limits are adequate to insure that a communications bottleneck does not defeat the purpose of the design.

Chapter 4 presents an overview of the selection process which was used for the network specified earlier in the paper.

CHAPTER 4

THE FINAL SELECTION PROCESS

SUMMARIZING THE NEEDS MATRIX

The final goal of the selection process is to match a specific network configuration with the needs which you have specified for the application(s) under study. Further, the intent of this paper is to couple this selection with a look to the future in a way which will give you the greatest probability of future endurance and flexibility. The suggested approach to accomplish these goals, satisfying current needs and providing for technological endurance, is to develop a summary statement describing the proposed network and then to match this statement with a network standard (IEEE 802.2 plus 802.3 or 802.4). In addition, it is suggested that the selection be tempered with an analysis of the existence, or the probability of the existence of a suitable gateway device so that the selected network will be able to link to other networks in the future.

To develop a network summary statement, you should refer to the needs matrix on page 8. Some of the issues in this matrix will influence selection of a specific type of network, other of the issues will influence the selection of a specific manufacturer's network over another **WITHIN** the specific type of network. The issues which are primary determinates of the type of network are:

PHYSICAL	- Existing cable; types of microcomputers, types of peripherals
SOFTWARE	- Type of access requirements (when coupled with number of concurrent users indicates speed reqmts)
PROCEDURAL	- Mass storage, concurrent users
FUTURE	- Growth capability, future hardware flexibility
OTHER	- Cost, limits to amount of facilities change you are willing to incur (mainly wiring considerations)

Issues which will influence your selection of a specific vendor's network within a network type are cost, features and quality of available network software, flexibility, stand-alone and boot-off-rom mechanics, and the stability and probable future of the vendor, especially regarding the availability of gateways.

Using information gathered from your network needs evaluation matrix, look to the issues listed above and prepare a descriptive paragraph which includes the key determining issues. The following descriptive statements and the selection which follows will serve as a guide for this final selection process.

SUMMARY STATEMENT	NETWORK TYPE					
	BUS CSMA/CD non-std	IEEE 802.3 Base-Band	IEEE 802.3 Broad-Band	IEEE 802.4 Base-Band	IEEE 802.4 Broad-Band	IEEE 802.5
Limited size and scope, defined hardware, no growth, >20 stations, cost limitations	X	X				
Small size (>41), future hardware flexibility important, speed important, growth possible		X	X			
Same as above but with possibility of shared wiring (voice or CATV)			X			
Medium - large size (up to 250) with large capacity, future hardware flexibility, some growth capacity				X		
Same as above but with possibility of shared wiring (voice or CATV)					X	
Medium - large size (over 1,000) with great expansion capability and future hardware flexibility						X

The example being used in this paper which is the subject of the evaluation matrix on page 8 could be summarized as a network which is small in size (>41), requires current and future hardware flexibility, with speed being an important criteria, with some growth capabilities (statement 2 above). This summary statement indicates that the appropriate network type(s) for consideration would be either baseband or broadband CSMA/CD (IEEE 802.3). Once this distinction is made, the process of selecting a specific network within this category will depend upon the remaining issues outlined in the evaluation matrix.

The statement made by this final selection matrix is that in taking a close look at the current and future needs that are to be fulfilled by the network being planned, the planner should be able to arrive at a network type which generally provides a "best fit" for these needs. Further, it is suggested that a specific

IEEE standard be adhered to in an attempt to insure future technological endurance. While some planners claim that gateways obviate the need for supporting evolving standards, it is strongly suggested that the availability or possible availability of gateways be used to hedge the bet for future flexibility rather than to guarantee it. An excellent example of this is implicit in IBM's marketing of the new CSMA/CD LAN(802.3) while announcing the IBM wiring scheme and lobbying for IEEE's 802.5 standard to be descriptive of their token ring plan. The CSMA/CD LAN will be available early in 1985, and will probably comply with IEEE 802.2 and 802.3. IBM seems to be betting that broadband LAN's will solve the immediate need for high speed, small networks, while the later more comprehensive solution (802.5) will probably be to tie the LAN's together with other networks in the token-ring approach, with each individual LAN being treated as a single recipient of the token for transmission purposes. If this is the direction, the token-ring network (ROLM CBX?) would act as a general gateway for the LAN Ethernets which will be widespread by the time the token-ring typology is marketed.

This speculation is important only in that it illustrates a main point of this paper, which is that the planner must select a network type which can accommodate the immediate needs which are identified, comply with IEEE standards for future endurance, and finally do a bit of guessing about a manufacturer's intentions if the best selection is to be made. Following this approach, even if the crystal ball gazing about a particular manufacturer fails, the adherence to standards will assure a decent future with a good return-on-investment for the selected network.

THE CASE STUDY SELECTION

After determining that the most appropriate network type would be an ethernet, and that the ethernet should conform to IEEE 802.2 and 802.3, while satisfying the greatest number of specified hardware, software, and procedural needs, the 3Com Ethernet hardware and software was selected. This particular equipment descends from the Xerox Corporations ethernet development history, and much of the technology is cross-licensed with Xerox and is compatible with Xerox's direction thus far, and supports the various hardware and peripheral devices specified in the requirements matrix. Further, the software supports all of the functions specified, and the procedural issue of "boot off ROM" is supported. Total conformity to IEEE 802.2 and 802.3 was not present at the time of the selection, but the "majority" of standards issues were complied with and 3Com claims intentions to completely conform in 1985. These facts, when compared to the other available network choices at the time of the decision (late 1983) made the selection of this specific network favorable, and the realities of installation and operation have verified, or at least not invalidated the selection. It should be noted that other vendors (notably Ungermann-Bass) have been aggressively pursuing ethernet products which conform to standards yet retain some degree of product differentiation for the marketplace. This tendency leads to "nearly standards compatible" networks which require gateways or bridges to communicate with other networks, and while this is not ideal for the consumer, it is bringing the ethernet world nearer to interchangability. Network manufacturers prefer to refer to the International Standards Organization's Open Systems Interconnection model (ISO's OSI Model) because this allows the manufacturer to pick and choose a set of network layers, which when combined conform to the model. This tendency is not creating solid communications compatible design, and is likely to be replaced with more specific top to bottom standards specifications when ISO accepts the IEEE standards (802.2 and 802.3 are complete, 802.4 is nearly settled, and 802.5 is evolving).

The model for network selection proposed in this paper is a process which will help guide the network planner through the requirements specification process, and later to match the determined requirements with a specific network type. The final step then is to determine which manufacturer's network will best fit the determined needs within the network type. It is up to the planner to keep updated on marketplace offerings, and most certainly to force standards conformance by selecting only those products which most closely conform to standards as these standards evolve.

TECHNOLOGY ROLLOVER:

Strategy and Tactics for the Implementation of an Advanced Information Systems Environment

by

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Technological innovation in the areas of Data Base Management Systems, Data Dictionary Systems, Application Development Software, and End User oriented reporting and analysis systems has exploded in recent years. For many large universities, these innovations have yielded little benefit because of the of the significant investment these institutions have in older systems technologies. This paper presents the approach to the problem of technology rollover developed at Michigan State University through its Core Technology Project. We will discuss not only the articulation of this strategy and its associated tactics, but also review the software selection process used in this project.

Introduction

Michigan State University is a public, single campus research oriented university with a total enrollment of more than 40,000 students. Michigan State has supported an administrative data processing or information services function for over thirty years. Because of its long history of administrative computing, MSU finds itself in a fairly common situation: we possess a massive investment in outmoded applications systems at the very time when we most need the benefits of modern systems technology. This paper describes the steps taken at Michigan State to free ourselves from the limitations of our older applications systems environment, and to "roll over" into an advanced information environment.

The principal service offered by MSU's Administrative Data Processing Department (ADP) is to provide for the timely, accurate processing of administrative information, and the presentation of that information in a form readily usable in support of University business requirements.

As is the case with many other institutions, we have experienced the continuing expansion of our client base. When considering the case of Michigan State, it is important to note that our newer clients have been the beneficiaries of most of the new systems we have developed in the last six years. For various reasons, the original components of our applications systems portfolio have remained fundamentally unchanged during this time. As a result, our systems development work has served to increase the volume of our activity, while leaving unchanged the underlying architecture of many of our most important operational systems.

As the volume of our systems activity has grown, our transaction velocity has also increased. This is a direct result of the types of systems ADP has implemented in recent years in response to client needs. Our new systems generally feature real-time file transaction processing. One impact of such systems is that file data now changes daily. There exists the need to mesh the data shared between these file-based systems. As a result, we expend considerable processing resources in the attempt to keep newer data systems in synchronization with older ones.

A further problem with our current application systems environment is that there is little program level data independence. This results in systems which require relatively large effort commitments to maintain, and which at least passively encourage the improper use of previously defined data elements, record formats, and disk space.

Strategy: Positioning for a New Information Management Environment

Obviously, one does not get out of a mess that required thirty years to create overnight - no matter what any vendor claims. The fact is that it takes work and lots of it. Not just by ADP, but by everyone associated with applications development. However, a necessary precondition to the success of systems developers is that the environment must be conducive to the development of the systems they are attempting. Therefore, for any attempt to implement advanced systems architectures to succeed, ADP must first be in a position to technically support such an architecture.

The opportunity to provide the University with an improved, integrated information environment was presented to us through a favorable set of circumstances. Although we have had a data base management system and data dictionary for five years, we just this year implemented our first applications using this data base technology. These are a fee assessment system, and a financial aid awarding system. Based on our experience with this particular data base management system and with data base application systems, we approached the prospect of using this set of tools for any other major development tasks with no small degree of trepidation.

Fortunately, our investment in systems using our older data base technology is small in comparison with our expected investment in three very large applications projects that are currently underway. These are an Employee Information System, an Alumni-Development Information System, and a new Student Information System. The fact that these application areas together represent more than half of our applications portfolio allowed management to consider alterations to the overall information environment with a degree of freedom they would not have enjoyed if our commitment to the older data base management system had been significantly greater.

We proposed a model for the extent of software integration needed to create an advanced information environment. The cornerstone of this environment is an integrated set of tools for the management and exploitation of the University's administrative data resource. The core technology constitutes an information management environment. This overall environment must be manageable and controlled, yet flexible enough to satisfy the varied needs of our clients.

First and foremost, these tools must be integrated, technologically sound, centralized and supportable so as to provide a solid foundation for the information management environment. From this base, specific facilities can be extended to a wide range of users within the University. Consistent with policy, we must be able to easily employ these tools to permit access to only that set of information for which a "need to know" can be demonstrated. In addition, data must appear uniquely and consistently. This environment must be capable of supporting an unlimited range of relational capabilities in order to support evolving University information needs as well as delivering views of the institution's data that are tailored to the needs of the end users.

Second, these systems and information delivery tools should remove all physical data restrictions, complexities, and technical demands embedded in our current systems, while at the same time providing for the full implementation of the University's access control policies in support of the individual's right to privacy.

Third, these tools must reference a common data dictionary. The results of all data design, definition, and distribution activities utilizing these tools should appear in the dictionary with a minimum of obtrusiveness into the processes of design, development, and implementation.

Fourth, to the greatest extent practical, these tools must not render unusable the University's investment in existing programs and data, while still delivering significant productivity gains to both the data processing professional and the end user.

Fifth, the software tools must allow extensions in support of batch or on-line operations, testing, and production needs.

Sixth, the core technology must be able to support efficient high volume transaction processing, while also providing sufficient access flexibility to support ad hoc reporting.

Seventh, this foundation should be predicated on a single set of tools. The preferred core technology should be based on the following components:

A single data base management system.

An active integrated data dictionary.

A fourth generation development language capable of exploiting the capabilities of the DBMS and Dictionary.

A set of end user development tools that extend from the fourth generation development language.

A set of reporting and analysis tools sufficiently sophisticated to support end user operations.

All of these tools should operate in our standard environment.

All of these tools should be accessible through either of our teleprocessing monitors, TSO and CICS.

This information management environment must also enable ADP to position itself to take advantage of technology currently available to meet both our near term and long range needs. This is a complex problem. The solution requires that new systems software tools and complimentary organizational structures be implemented in order to exploit this environment. The organizational structures required are: the Development Center, the Information Center, and the Data Administration Center. Their functions are briefly described below:

Development Center

The Development Center exists to provide ADP professionals with support for the set of integrated software tools used in the development of applications. It is staffed to provide guidance in the currently recognized standards and approved techniques for use in the tasks of system and program design. It also serves as the focal point for the dissemination of knowledge of advanced usage techniques of the application development software complement. The Development Center should be staffed by persons with a strong understanding of both the software and how it is best utilized in the actual development of application systems.

Information Center

The Information Center is a support organization similar to the Development Center, but differs in that it is charged with the task of providing direct assistance, consultation, and training to end users. This organization provides access to and understanding of a set of integrated software tools intended for use by end users in the development of their own applications.

Like the Development Center, the Information Center is staffed to provide guidance in the currently recognized standards and approved techniques for use in applying the software in the solution of business problems. It also serves as the focal point for knowledge of advanced usage techniques of the Information Center software complement. To be successful, the Information Center must be staffed by persons with a strong understanding of both the software and end user operations.

Data Administration Center

Data Administration supports the data management needs of data processing professionals, end users and institutional planners with facilities designed to deliver, manipulate, model, and report on the status of data within the core technology.

Cost and Benefit Analysis Supporting This Strategy

We expect that the overall impact of an advanced information environment will make it possible to reduce the length of time required in the systems development life cycle. We also expect that by providing a high degree of program level data independence, it will result in an environment into which subsequent changes can be more easily accommodated. These two developments will enable us to leverage the talents of highly skilled users and data processing professionals.

Implementation of an environment using this technology directly supports the implementation of systems such as the Student Information System and the Alumni Development Information System within more reasonable time frames, and at lower cost than would otherwise be the case.

The core technology provides the technical base to administer the central data resource efficiently. These tools, and especially the active data dictionary, provide a full function means to control the central data resource in a manner which is relatively unobtrusive into the processes of development, testing, and implementation.

Because of the high level of sophistication designed into the components of the core technology, it provides the technical base to implement data and system access policy as these are determined by the appropriate University entities.

What reducing the length of the development cycle means in terms of additional ADP productivity is illustrated in the example below. This example is based on the following set of assumptions:

1. The four year cost of the core technology software is $437,337. ($316,200 to acquire + 123,137 to maintain)

2. According to studies recently published in several professional publications, the real productivity gain associated with fourth generation languages is about 3:1 over the use of third generation languages (most notably COBOL). For this illustration we will use a general productivity gain of 2:1.

3. We assume that the core technology comes "on stream" in terms of having an impact on the way in which data processing professionals do their jobs in the following manner:

   During the first year of installation there is no appreciable impact. As familiarity with the tools grows, and as projects using them are completed and implemented, we assume that productivity will grow by 25% in the second year of installation, 50% in the third year, and 75% in the fourth.

4. We assume that the staff of Administrative Data Processing is composed of 30 professionals who use this software on a daily basis. For purposes of illustration we will assume that the average cost for each of these is $25,000 per year (including benefits), so that total staff cost is $750,000 per year.

5. We assume that the increased capability to produce more will result in more actually being done.

Based on these assumptions, the value of the core technology can now be expressed in terms of additional work output as follows:

Year	Gain	Additional Output Worth
1	0%	
2	25%	$187,500
3	50%	$375,000
4	75%	$552,500

Cumulative Four Year Total:	$1,115,000
Less Cost of the Tools	($437,337)
Value of Net Benefit	$677,663

(expressed as the value of the additional work produced)

Benefits to Users

Because the core technology software reduces the time required for data processing professionals to design, code, test, and implement systems, users will gain benefits from these systems sooner.

Because the core technology software is sophisticated enough to meet the data access and retrieval needs of a broad range of users, many users will benefit because they no longer require the direct services of data processing professionals in order to gain access to information in a timely manner. In this way we will be able to further leverage the skills and knowledge of our customers.

Users will benefit because central data is organized, defined, reliable, controlled, and accessible.

Customers using this set of tools to develop certain of their own simpler applications will benefit because their data is organized, defined, and controlled by the user without the necessity of administrative bottlenecks.

Costs to Users

Because "doing it yourself" takes time and effort that might be spent doing something else, users and their departments will need to take personnel, as well as information retrieval and processing costs into account when determining the amount of this activity they can really afford. In any particular case the extent of direct usage will depend on the amount to be done that could be done more effectively by someone else.

Users will need to be aware of the necessity to budget time for training. While we have sought to recommend end user oriented software products that require relatively little formal training, there will still be some training or orientation necessary, at least initially.

Benefits to Administrative Data Processing

Because the core technology software reduces the time required for data processing professionals to design, code, test, and implement systems, ADP will benefit from being able to meaningfully address the applications backlog. The core technology allows the development not only of larger systems faster, but also reduces the benefit payback threshold for all systems, meaning that this will enable ADP to build smaller systems faster as well.

Because the core technology software will enable ADP to get more done with current resources, it means ADP will become a more productive service unit, able to respond more rapidly to the needs of our clients.

Costs to Administrative Data Processing

The recurring costs of continuing user and staff support will need to be be met within ADP. This is but a part in the establishment of both the Development Center and Information Center. This will include the following: Training for ADP staff to use not only new tools but new approaches; and training for user staff, including providing design and technical consultation services.

ADP must develop a resource usage accounting mechanism that addresses the accounting for the use of systems resources whether used by ADP staff or by end users. Without this, resource allocation and effective administration of the more extensive end user capabilities will be difficult, if not impossible.

Tactics: The Core Technology Project

At Michigan State, we implemented this strategy in the following way. In February, 1984 the Data Base Administration group was formally established within Administrative Data Processing. The first task assigned to this group was to review the current technological and support environments available through Administrative Data Processing, provide an assessment of their relative strengths and deficiencies, and recommend a course of action. This provided the opportunity to define the issue. It also enabled us to highlight alternative solutions. This proved beneficial in that it tended to render the status quo problematic. It also gave us the opportunity to establish "positive inertia." By positive inertia we mean not just the momentum related to this one task, but the capability to start a long-lived series of events that follow from a precipitous cause. Our thoughts here were directed to the positioning necessary to support the establishment of a true integrated applications systems environment at Michigan State.

Summarizing our assessment, we found that ADP was experiencing increasing demand for more diverse types of service. We determined that the applications backlog would continue to grow at a rate that would exceed the capabilities of current development technology to meet such needs. We concluded the only avenues offering solutions required significant additional investment in either staff or tools. From this our research concluded that an emphasis on improving staff and user productivity was likely to provide significantly greater return in the form of product delivery than would the mere acquisition of additional staff. We recommended that the Department continue its efforts in the area of identifying and recommending a core technology.

We were fortunate to have the support of the Vice President for Finance and Operations, and Treasurer. His sponsorship of our activities during this technology assessment and the subsequent Core Technology Project provided not only the resources necessary to carry out the project, but provided an important sanctioning for our activities.

We realized that the scale of activity necessary to successfully complete this work within an acceptable timeframe required that a large project team be formed. We also recognized that development project efforts associated with both the Alumni-Development Information System and the Student Information System depended on this project being completed by the end of August, 1984.

Composition of the Core Technology Project Team

In early May, 1984 the task of assembling the project team was completed. Following staffing consultations within ADP management, the decision was made to assemble an eight member project team that represented a cross-section of perspectives. Core Technology Project team members were selected from the Information Services, Systems Development, and Systems Enhancements staffs of ADP.

Consultation Inside and Outside of ADP

In order to identify an integrated set of criteria by which to evaluate this technology, the project team solicited input from various audiences from both inside and outside of Administrative Data Processing:

In the area of processing requirements for the data base management system component, we drew extensively from the requirements definitions now in place for our major systems activities.

In the area of the data dictionary, we received input from Data Resource Administration in the Office of Planning and Budgets.

The project team surveyed the applications programming staff of ADP for input related to high level applications development software.

We received both specific and general input from the Management Systems Coordinators.

Because of its broad institutional composition, we sought input relating to end user reporting and development from the Easytrieve Users Group in the form of a survey and follow-up presentation.

Our intra-university contacts proved to be very useful in confirming our understanding of the needs of our customers. They proved to be especially useful, though, in helping to make our customers aware of our activities in their behalf.

We obtained additional information, including reports, from contacts at other universities that had recently conducted similar software reviews (Auburn, Colorado, Iowa, Kentucky, and Stanford).

Development of Evaluation Criteria

On the basis of information obtained through the sources above, as well as through the professional literature, the project team constructed the detailed set of evaluation criteria. These criteria were completed in unweighted form, and presented to ADP management in a document called the Core Technology Project Interim Report. Copies of the Interim Report were made available for review and comment within ADP, and were presented to the ADP Steering Committee for review and comment.

Because of staff commitments to other projects, final weighting of the items contained in the evaluation criteria were not completed until after the presentation of Interim Report. The weightings were made available to members of ADP management and the Steering Committee.

Selection of Vendors - Preliminary Round

Eight vendors were selected on the basis of their claimed capability to deliver a complete, integrated product line consisting of a data base management system, data dictionary/directory, application development tools, and end user oriented tools for a large IBM system environment such as Michigan State's. The pool of possible vendors was restricted to companies that had been in business for ten years or longer with more than fifty sites licensed to use the data base management system. In addition, we also required that the vendor's software must run using IBM's Multiple Virtual System (MVS) operating system, and use for its teleprocessing monitor either IBM's Customer Information Control System (CICS), or IBM's Time Sharing Option (TSO).

Product information used in this part of the selection process was obtained (1) from Datapro Research Corporation, an independent research organization, (2) from information obtained by ADP through our attendance at product seminars, (3) from other research in the area of data base management systems.

Preliminary vendor presentations were scheduled. The principal purpose for the preliminary round was to expose the project team to the product offerings of several vendors. The format for these presentations involved two parts. In the first part, the vendor was allowed to make a formal sales presentation. After the sales presentation, the meeting was opened for general questioning of the vendor by all in attendance. In addition to sales staff, all vendors were asked to bring technical staff so that technical questions could be answered in the course of the presentation. In addition to the project team, ADP senior staff and management, and the Data Resource Administrator were invited to attend all of these presentations.

All vendors except one were invited to participate in preliminary round interviews. The reasons for the exclusion of one vendor from the initial round is that this party was the vendor of our current data base and data dictionary software.

Selection of Finalist Vendors

On the basis of material presented during the preliminary round, the project team selected the four vendors whose software of was considered to provide the best overall combinations of data base, data dictionary, application development tools, end user tools.

Detailed Information Requested from Finalists

In order to perform a detailed evaluation of the finalist products the project team issued a request for information to the four finalists. The contents of the request for information were identical to the criteria presented in the Interim Report.

Each vendor was provided a copy of the unweighted evaluation criteria and instructed to reply to each point in writing. Vendors were also instructed to provide product documentation to substantiate each answer. Vendors were given a fixed period within which to reply.

Evaluation of Finalist Responses to Request For Information

The answers provided by the vendors, along with the supporting documentation they provided, formed the principal basis for evaluating the finalist products. The vendor responses were retained in Administrative Data Processing along with the other permanent project documentation. The responses are available for review through ADP. The vendor documentation remains the property of the vendors and will be returned to them.

In order to provide a means of presenting an overall assessment of fit, the project team assigned a weighting factor to each of the major feature areas presented in the evaluation criteria, and scored each response. Item response scores within each area were tabulated. Each area score was then expressed as a percentage, and further weighted by multiplying the area percentage by the area weighting. The area weightings used in this evaluation were:

General Criteria	10%
Data Base Management System / Data Dictionary	40%
Application Development	25%
End User Reporting and Development	25%

Final product scores were obtained by adding the total of weighted area scores for each product.

Additional Measures Aiding the Evaluation Process

The project team arranged for demonstrations of the various products of the finalist vendors.

As part of the detailed evaluation of the finalist products, the project team conducted visits to at least one customer site for each of the finalist vendors. These visits not only provided an opportunity to discuss vendor support and product capabilities with a company actually using these software products, but also provided the opportunity for the project team to actually see these products in a working environment.

The final step in the detailed evaluation of the finalist products involved phone calls to companies from lists of references supplied by vendors. In addition to companies supplied by the vendors, the project team also contacted other companies whose names were supplied to us by the reference companies.

Results of the Evaluation

The major finding of this evaluation evaluation was the documentation of the need for a different set of products to support development center, information center, and data administration center activities. On the basis of our evaluation, we determined that the needs of Michigan State would best be served by a set of products from Cullinet Software, Inc.

The work of the Core Technology Project Team was completed by the end of August. Our findings were reported in early September to ADP management and to the ADP Steering Committee who endorsed our conclusion. Finally, we presented the report to the Acting Vice President for Finance and Operations and to a group of other Vice Presidents.

We received Vice Presidential approval to begin negotiations with Cullinet Software in early October. We concluded negotiations and signed contracts with Cullinet on October 31, 1984.

Results of the Positioning Strategy

At this writing, we have acquired the Cullinet software. We have initiated a training program for members of the Data Base Administration group, and certain members of the applications programming staff. We intend to install this set of products in January, after these key members of the staff receive sufficient training in it to be able to use it immediately.

In September the name of ADP was changed to Administrative Information Services (AIS) in order to more accurately reflect the current mixture of services provided to our customers.

We have identified a small, internal-to-AIS pilot project for initiating the use of this software set. We expect to complete the pilot before the end of the second quarter of calendar 1985. Associated with the pilot project is the need for ADP to critically reevaluate many of our standards and common systems development practices. We hope to ensure that these standards and practices are upgraded to include the new techniques associated with the use of the new tools.

We will not only need to examine the impact of these tools on the activities of the programming staff and the support group, we will need to carefully determine the extent to which we are successful in modifying the dimensions of the systems development lifecycle. This will be especially true in the areas of responsibility associated with Data Base Administration and Data Resource Administration.

AIS has committed to the new set of tools as the technology of preference in the development of larger, integrated applications. AIS has also committed itself to the position that we will not merely "roll over" our existing applications portfolio into the the new technology. At first reading this may sound contradictory to the whole thrust of the AIS positioning strategy. A further examination of the issues related to the implementation of data base as a way of approaching the systems development process serves to illuminate why this position is desirable.

Simply rolling the current applications over into the new technology would simply add the overhead associated with the data base management environment to systems that currently use excessive processing cycles because they are not predicated on a shared data model. In short, we would achieve all of the overhead and none of the benefits of the data base approach if we supported "simple rollover."

Instead, AIS is proposing that existing data resources be rolled over into the technology only as a step in a project to consciously restructure the data resource environment. This will most often occur when an existing application system is replaced in its totality by a new system. Such is the case with two projects now underway, the Alumni-Development Information System and the proposed Student Information System.

In terms of the impact of this technology on end users, AIS has taken the position that no global statement can be made regarding the extent of the resource commitment required to adequately support end users of this technology until such time as the detailed specifications are completed for each of the major systems projects now considered for development under this technology. The reason for this is that we view this software set as providing the potential for as much, or as little, end user activity as they themselves desire. For instance, there is nothing in this set of tools that requires end users to prototype new systems before ADP will talk to them. Similarly, AIS will not require end users to perform all of their own reporting.

It is important to keep in mind that our strategy is to position AIS so that we may readily respond to the needs of the customer, whether that need be for access to tools, access to data, or access to services. Our tactics have been developed to facilitate the successful implementation of this strategy.

NETWORKING LIBRARY AND COMPUTER SERVICES INTO THE INFORMATION AGE

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Abstract

A local area broadband network implementation at Bentley College is providing the basis for developing a wide spectrum of on-line information services to thousands of students, faculty, and staff users of personal computers and terminals. The nature of these information services is examined; the motivation for integrating access paths to bibliographic and computer center data base resources is outlined; and goals, constraints, and systems alternatives are presented. Models of other advanced educational and research plans and experiments for providing dynamic access to on- and off-campus information facilities are also identified.

Introduction

Bentley College is primarily a business-oriented institution serving over 7,000 full-time-equivalent undergraduate and graduate students. Computer and information services are being integrated into all areas of the curriculum and administration. "The College made an early commitment to recruit faculty and support staff and provided the necessary funds to achieve preeminence in computing amongst schools of business nationwide."[1] The Computer Information System faculty now numbers 28 full-time and 18 part-time. "The department offers service courses for the college at large and specialized courses for 1,000 majors in CIS. In addition to CIS, we have seen the integration of computer use in over 150 of the 600 course sections that are offered each semester." (ibid.) Many faculty workshops on use of microcomputers for coursework have been given. Bentley students will now be using micro-computers as a normal part of their daily business, computer, arts, and sciences courses.

With on-line, distributed access via our local area network to a variety of computer processing and database sources, students, faculty, and staff can prepare text for various reports and perform calculations on numerical data. However, another major source of information exists within the campus library and in off-campus databases, which is not presently accessible on-line. Many automation packages have been examined, but as yet no specific plans have been formulated to select and install an integrated system for circulation acquisition, or on-line bibliographic search. Some functions of the library utilize computer services, such as an OCLC generated card catalog, reference searches to national databases, and a few "homegrown" acquisition and reporting programs.

Against this background, Bentley has just hired a new Library Director who is examining some fundamental questions of information services for education and research at the College, and in particular what functions and forms of automation are appropriate and can be justified. Furthermore, within the past year the first phase of our local network was installed, and even more significantly the position of the computer center director was elevated and expanded into a new position of Vice President of Information Services. Given the emphasis on computing and information services at Bentley, we will begin to see a major increase in library and computing center interactions, with the local area network providing a fast and effective access mechanism to both major information sources. Specifically, this author[2] believes that a goal of on-line access to distributed library and computer services through networked personal computers is necessary and will be justified, as Bentley evolves into the information age. The strategy to achieve that goal may take many forms.

Library Search and Models

The past five years of Annual Review of Information Science and Technology, volumes 13 through 18 (1978-1983) were examined for all literature sources bearing on the topic of on-line access to bibliographic sources. The following authors, with article titles and sources are presented in the bibliography at the end of this paper: Cawkell, Evans, Griffiths, Levitan, Lundeen, Palmour, Smith, Veneziano, and Zimmerman.

A small but comprehensive book was consulted to help structure this research paper: Information Systems and Networks by Samuelson, Borko, and Amey[3] provided insight and practical guidelines of informatics for the planning, design and management of general systems for processing, storage, retrieval and dissemination of information and knowledge.

Some excellent material has been published on how information will be accessed in the future. Hiltz and Turoff's book, The Network Nation[4], paints scenarios of how our graduates will probably be communicating in the electronic information age of 1990.

Lancaster[5] describes the future library, in terms of evolving toward electronic publishing and economically justifiable access devices to networks of information sources. His scenario of a typical scholar is not too far into the future, and in fact takes place now in a few advanced research environments:

> "George maintains his calendar in electronic form. It is the first thing he consults when he logs onto his terminal in the morning. After his calendar, he consults his electronic mail, which falls into three categories: personal messages, messages directed to all members of the research group to which he belongs (his electronic invisible colleges) and notifications of new publications that match his stored interest profile. Some of the mail he responds to immediately. Other items are discarded and yet others stored for future action. George belongs to a very wide network of colleagues, working in the same research area as himself; he communicates regularly with about 20 scientists in five countries and less regularly with many others. Altogether, he maintains direct contact with scientists in 18 different countries."

Matthews[6] provides us with a comprehensive and up to date review of public access to on-line catalogs: current alternative forms of library catalogs, choices for on-line catalog design (in-house development, turnkey system, etc.), user types and human-computer communication components, various types of terminals, computer system considerations (reliability, backup catalogs, response time), database (access points, database coverage, length of records), operations (type of search), effects on library patrons and staff, and finally, planning and implementation considerations. Fattig[7] describes current uses of microcomputers as communication devices to access several specific national bibliographic networks, and to perform electronic publishing.

Models of other universities' plans for networking computer services and library services have certainly influenced this author. Brown, Carnegie-Mellon, Dartmouth and Stanford have all exhibited visions of what educational institutions should be doing to prepare students for the information age. For example, Shipp, et al.[8] describe the function and uses of the scholar's workstation at Brown:

> "The scholar's workstation starts with a powerful yet simple-to-use user interface. The interface is a consistent graphics-based metaphor of user interaction with the workstation. It is also consistent over the family of workstations, being the same on the low-end student device and on the high-end research/engineering machine. Rather than presenting the user with the idiosyncratic, user-hostile, one-of-a-kind interfaces common in today's timesharing utilities, the scholar's workstation will provide a common, well-integrated portal to traditional sources of information: library, electronic mail, desk calculator functions, personal database, etc."

A comment from McCredie[9] is worth noting at this point:

> "Libraries and computer centers will draw closer together. Similarities in information processing functions and needs are emerging and will become more important than historical differences in organizations. As library materials increase in cost by yearly rates of about 20 percent and computing hardware costs decline by about 25 percent per year, information systems will be used in more innovative ways. This trend will accelerate as more commercial organizations publish and distribute materials in electronic ways. Access to bibliographic data and archival information through common terminal networks will allow faculty and students to search online catalogs or use several computers, both local and remote, for such standard current applications as statistical analyses and simulations."

What implications do these models have for Bentley College?

Analysis and Alternatives at Bentley

First, Bentley is a smaller and more specialized college than the major research universities above. Regarding our library, we have only 130,000 volumes, add 4000 books per year, and make 30,000 circulations per year.

As described in the introductory section, many significant events have occurred recently at Bentley leading up to this consideration of networked access to both computer and library services. During the past two years, campus-wide communications planning has been underway to integrate voice, data, video, security and energy information access and transfer. The library, and its media services department, have served as experiments for six different graduate student system analysis and design projects, under the direction of this author. There has been more emphasis on research at Bentley recently, we are undergoing the AACSB accreditation process, and our graduate programs are expanding. It is inevitable that on-line access to both on- and off-campus information sources becomes a reality; the question is when and in what form.

On-line access to information sources should be available to the College community of staff, students, and faculty; additionally provisions must be made for access to outside organizations with whom Bentley has established arrangements for sharing information resources. Access privileges, security, and privacy considerations must be determined and established for each class of user.

Our primary system constraints include existing owned computer hardware and network facilities: 5 Prime super mini-computers, 200 Hewlett Packard personal computers, and an Ungermann-Bass broadband local area network. A recent Library High Tech[10] journal reported on New York University's local area library network using Ungermann-Bass technology which Bentley can learn from. The HP DSN/LINK network access software could be used to interface the HP 150 and 110 model micro-computers to computer and library services. Plans are to have at least two thousand micro-computers on campus within two years, for most student, faculty and staff users.

Current automation activities[11] in the library include an inhouse developed system (LIBSYS) that has been used for capturing data on all book acquisitions, receipts, and processing since 1978. The system has proven to be valuable in tracking library book expenditures and in producing reports. A major retrospective conversion project is nearing completion, to convert all cards cataloged since 1978 into the OCLC catalog database. OCLC services are used for on-line cataloging and interlibrary loan. Bibliographic database search services, such as the Lockheed Dialog Search and LEXIS are brokered through NELINET (New England Library Network).

During the past year there has been a significant amount of analysis of our library operations and automation requirements, primarily by my graduate student project teams. Other libraries' systems have been observed, and many vendor packages have been evaluated. This analysis and evaluation has considered integrated systems including: on-line catalog, circulation, acquisitions, cataloging, serials, interlibrary loan, on-line bibliographic reference, archives, media equipment scheduling and inventory, bibliographic instruction, community interest files, and reporting capabilities (managerial, statistical, financial).

Networking arrangements with other regional libraries or library networks, including public, academic, and industrial must also be considered.[12] However, the driving force for our library automation effort must be the information requirements of faculty, students, and staff, rather than simply a computerization of current library manual operations and procedures. This driving force of information requirements implies quick and effective access to both library and computer services information sources -- probably through one's personal computer. The bottom line, of course, is a justification process for the additional major expenses (capital and operational) of installing on-line integrated information services.

Summary and Information Systems for the Future

During the recent October 30 - November 2 EDUCOM conference in Cambridge, Ma., William Arms of Dartmouth outlined four levels, or stages of information systems in libraries:

1. Inventory management (i.e., library circulation automation, using data and transaction processing)
2. Factual catalog (i.e., on-line catalog, Dow Jones service, census data, using database queries, controlled vocabularies, thesauri and authority files techniques).
3. Inference (i.e., extraction and combining of data in numerous unanticipated ways, using expert systems, or knowledge engineering, techniques).
4. Interdisciplinary study (i.e., synthesizing information from a variety of independent databases oriented toward different audiences, by way of open systems network interconnections and extensible user interfaces).

At this time, Bentley only has a few elements of Arm's stages 1 and 2. Some of the major universities have integrated stages 1 and 2, and are entering into the 3rd (Inference) stage. No operational library Inference systems apparently exist today; however, OCLC just advertised for a "Research Scientist, Expert Systems" in the November '84 issue of Communications of the ACM. Although research and experimentation is being conducted into (Stage 4) inter-disciplinary information search techniques, we can expect some good progress primarily due to the proliferation of networks connecting university researchers and database both nationally and internationally (i.e., BITNET, CSNET, MAILNET).

We are drawing upon the models and experiences of others in our attempt to plan and implement an integrated library and computer services information network. But we know it will be difficult to justify the expense of automating our relatively small book circulation and to provide on-line access to our library catalog. Much of our faculty and student information research requirements require access to the latest journals, which are either readily accessible in the library or through interlibrary loan. On-line searching of national databases (through our reference librarians) is doubling every year. We will probably simply expand in this Stage 2 era of on-line searches and cooperative access to other collections, putting Stage 1 (Inventory management) on hold for another year or two. Meanwhile, microcomputer usage is escalating and the campus is being networked. As an independent, specialized college, Bentley is seeking an innovative and balanced approach to meeting our on-line information requirements.

Finally, along with the theme of this paper, let us keep in mind the words of Patricia Battin[13] (Vice President and University Librarian at Columbia University):

> "The obvious answer to the Electronic Scholar's plight is the formation of a Scholarly Information Center by merging the Libraries and the Computer Center to provide an information infra-structure to stimulate the continuous use of information sources. The integration of Libraries and the Computer Center, each with its specific strengths and expertise, will provide one-stop shopping for the University community as well as a stabilizing planning mechanism for effective and flexible response to rapidly changing technologies. The Electronic Scholar will require both the capacity for flexible response to change and the assurance of stability as he/she becomes dependent upon electronic information systems."

Footnotes

1. Anderson, Dennis A.; Plourde, Paul J., "A Strategy for Transitioning from Computer Literacy to Computer Fluency," Proceedings of Annual Meeting of International Business School, Computer Users Group, Iowa City, Iowa, August 1984.

2. Chew, Robert L., "Planning for Distributed Systems," CAUSE National Conference Proceedings, San Francisco, Dec. 12-14, 1983.

3. Samuelson, K.; Borko, H.; Amey, G.X., Information Systems and Networks, North-Holland, 1977.

4. Hiltz, Starr Roxanne; Turoff, Murray, The Network Nation, Addison-Wesley, 1978.

5. Lancaster, F.W., "The Future of the Library in the Age of Telecommunications," in King, Donald W. (Ed.), Telecommunications and Libraries, Knowledge Industry Publications, 1981.

6. Matthews, Joseph R., Public Access to Online Catalogs, Online, Inc., 1982.

7. Fattig, W. Donald, "Networking in Academia," Collegiate Microcomputer, Vol. II, No. 1, Feb. 1984.

8. Shipp, William S. et al., "Experiments with Scholar's Workstation Networks in a Wired University: Proposal to the System Development Foundation," Brown University, March 28, 1983.

9. McCredie, John W. (Ed.), Campus Computing Strategies, Digital Press, 1983, pp. 8, 9.

10. Persky, Gail et al., "A Geac Local Area Network for the Bobst Library, Library High Tech, Issue 6, Vol. 2, No. 2, 1984, pp. 37-45.

11. Cathcart, John, "Technical Services Overview and Future: Five Year Project," Bentley College, November 1983.

12. Dugan, Robert; Bjorner, Susan, "Automated Resource Sharing in Massachusetts: A Plan," Library High Tech, Spring, 1984, pp. 73-82.

13. Battin, Patricia, "The Electronic Library: A Vision for the Future," EDUCOM Bulletin, Summer, 1984.

Additional References

Cawkell, Anthony E., "Information Technology and Communications," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 15, 1980, pp. 37-65.

Cline, Hugh F.; Sinnott, Lorraine T., The Electronic Library, Lexington Books, D.C. Heath Co., 1983.

Evans, Glyn T., "Library Networks," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 16, 1981, pp. 211-245.

Griffiths, José-Marie, "The Value of Information and Related Systems, Products, and Services," Annual Review of Information Science and Technology, American Society of Information Science, Vol. 17, 1982, pp. 269-284.

Levitan, Karen B., "Information Resource(s) Management - IRM," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 17, 1982, pp. 227-266.

Lundeen, Gerald W.; Davis, Charles H., "Library Automation," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 17, 1982, pp. 161-186.

Palmour, Vernon E.; Roderer, Nancy K., "Library Resource Sharing Through Networks," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 13, 1978, pp. 147-177.

Smith, Linda C., "Artificial Intelligence Applications in Information Systems," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 15, 1980, pp. 67-105.

Veneziano, Velma, "Library Automation: Data for Processing and Processing for Data," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 15, 1980, pp. 109-145.

Zimmerman, Edward K.; Brimmer, Karl W., "National Planning for Data Communications," Annual Review of Information Science and Technology, American Society for Information Science, Vol. 16, 1981, pp. 3-49.

Track IV
Office Automation/Networking

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A DEPARTMENTAL NEEDS ASSESSMENT:
Finding the Requirements

by

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ABSTRACT:

This paper presents an overview of a set of studies on the use of automation in the office performed at Stanford University beginning in the Summer of 1983 and culminating in a final report in November of 1984. The paper further summarizes the study findings and the resulting recommendations. Although the specific results may not be of direct interest to a non-Stanford reader, the ideas used in developing the study, the approach taken, and the recommendations resulting from this effort may provide some insights to other institutions.

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BACKGROUND

At the beginning of this decade, Stanford began to focus more and more on the idea that although information technology was being very successfully applied to the administrative needs of central offices, the highly distributed academic departments had seen no such assistance. Moreover, it was believed, those academic departments have as many administrative needs, if not more, than do the central ones. Out of this thinking came the strategic concept of placing the department (and the individual) at the center of information processing and the so-called central departments at the periphery.

In order to reasonably follow up on that strategic concept, the University had to find ways to effectively implement the idea. Out of that concern was born the idea of conducting a thorough analysis/study of all departments (including central ones) as a way to uncover and prioritize the real needs of these more than 300 departments at Stanford.

INTRODUCTION

Beginning in the Summer of 1983, the Administrative Information Services organization conducted a series of exploratory interviews and culminated that with a report in September of the same year. The results of that first phase were used to aid in the development of a comprehensive survey which was conducted in the early Spring of 1984. The questionnaire was distributed to 1,000 administrative staff members and obtained a response rate of over 42%. This paper summarizes the resulting report published in November by highlighting the survey data findings and presenting an overview of the recommendations based upon those findings.

SURVEY RESULTS

A. Levels of Office Automation

- A large majority of administrative staff have at least some experience with computers.

- The average Stanford administrative employee automates over one-third of his or her administrative tasks.

- The majority of respondents do not use central automated administrative services.

- Many of the most frequently performed administrative tasks are not automated.
- Compared to other channels of communication, the online mode is used infrequently for administrative work.
- There are major hubs through which University administrative information flows.

B. Knowledge and Attitudes Towards Office Automation

- The best predictor of more automation is automation itself.
- There is a lack of knowledge about office automation technology in general.
- There is a lack of knowledge about existing automated systems on the central administrative computer.
- There is a negative relationship between the number of tasks an individual performs and the degree of automation applied.
- Attitudes about office automation in general are quite positive, however, perceptions of self-competency with regard to computers are lower.
- Administrators who hold more favorable attitudes towards automation in general as well as positive attitudes about their own self-competence, automate more tasks.
- Administrators report a definite need for more automation, in particular, inter-office, online communication, and administrative information flow capabilities.
- Some staff indicate that lack of funds as a reason for not automating more.
- Many staff members say they would use electronic communication if they could afford the service.

C. Variation in Degree and Use of Office Automation

- There is a great variance both in the type and degree of automation among administrative offices.
- Central administrative offices have a higher degree of automation than academic administrative offices.

- Within academic schools, there is variation in both tasks automated and the types of equipment used.
- When automated, administrative tasks are more frequently automated on standalone equipment than the central system.
- There is variation in the use of automation across job classifications.
- Some administrative tasks are automated more frequently than others. Word processing and spreadsheet type applications are used more frequently than database management and online communications type applications.

RECOMMENDATIONS

Based upon the findings from the survey data (both the baseline measurements of automation and the degree of cross-sectional variance throughout campus offices), the study team developed several recommendations for improved office automation at Stanford. There are both short term needs which should be addressed immediately to ensure a reasonably rapid assimilation of technology presently available, as well as longer term needs which, when met, will help the University better provide an environment which allows the highest return possible on its automation investment.

A. Office Information Systems Strategy

In order to help meet longer term needs, to provide direction to the institution, to deal with diversity and convergence, to manage interfaces and data exchange, to allow innovation and experimentation, and to increase benefit and reduce overall costs, a recommendation was set forth to develop an Office Information Systems Strategy. Work on this strategy should begin as soon as possible but should not interfere with the need to continue to provide ongoing support services for departments today.

B. Support Services

To meet more immediate and short-term needs, it was recommended that additional support services be implemented immediately. Recommendations for these services are divided into the following three basic issue areas: knowledge and attitude, system availability, and communication.

Knowledge and Attitude

Both knowledge and attitudes are affected by experience. This means education is important to increased and improved office automation. Education must address both human factors (for example, fear of failure) as well as technical training. Education in three particular areas is recommended: (1) education about office automation in general, (2) specialized skills training, and (3) assistance in implementing office systems technologies in the office environment.

Objective information should be made available about office systems in the commercial marketplace as well as administrative services on the central system. On-going training should be offered to staff members on specific hardware and software products, for both micro and mainframe systems. Specific training programs should be offered for both beginner and more advanced students. And other programs should be developed which demonstrate the integration of specific tools into the administrative work environment.

System Availability

As the survey findings indicate, there is uneven use of office automation throughout Stanford offices. In order to broaden the use of office systems technologies and to enhance their application, three action areas were recommended: (1) provide additional automated systems, (2) reduce blocks to automation, and (3) manage office systems compatibility.

Towards the goal of providing additional automated systems, it was recommended that Stanford develop automated systems which will allow departments to improve their effectiveness and productivity. Towards the goal of reducing blocks to automation, there are several factors which must be considered, including lack of funds, lack of knowledge, ease of use, and availability of systems. Factors which can help reduce office automation blockages include education, such as showing staff how to see their tasks in more generic terms rather than as many fragmented tasks, a 'self-help' educational program in which those who automate can teach themselves to reach even further and a program of 'peer-education' in which staff members teach their colleagues. Consideration of loan programs or unpriced support to departments was also recommended to help reduce blockages to automation. In order to manage compatibility between office systems technologies, it was recommended that new acquisitions conform to a minimum degree of communications compatibility. This does not mean a proscriptive standard which legislates standard equipment and software, but rather conformance to minimum standards.

Communication

It was recommended that steps be taken to increase the use of online communication throughout the administrative staff of the University. The survey results clearly indicate a high degree of desire amongst University administrative staff to use this technology, but in some cases the lack of funding to do so. Perhaps some sort of online communications funding program or unpriced support to departments could be established to accomplish the goal of increased online communications.

Online communications is a major means by which office systems technologies are successfully introduced to administrative staff. The expansion of online communication would be a great step towards increased office automation at Stanford.

C. Further Study

Finally, it was recommended that office automation at Stanford be monitored on an on-going basis. This study has developed baseline measurements on several aspects of office automation. These measures can serve as departure points for continued assessment of office automation trends as well as for assessing deliberate actions taken by Stanford in this arena.

Integration Strategies
for
Office Automation and Data Processing

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The introduction of office automation technology is consuming a significant level of resources in many institutions. To maximize this investment, a strategy must be developed to integrate office automation, existing information systems, and existing data processing facilities. To be successful, the facilities provided by the office automation technology must be made available to all participants in the existing network. In addition, transaction processing, decision support, and other mainframe facilities also need to be available within the office automation environment.

This paper will address the approach and solution developed at Michigan State University by the Administrative Information Services Department. This solution is based on the current IBM direction and technology, and incorporates IBM's Distributed Office Support System (DISOSS) and the IBM 5520 Administrative Office System.

Introduction

Michigan State University is located in East Lansing, Michigan, with an enrollment of approximately 40,000 students. The Administrative Information Services Department (AIS) provides administrative data processing support to all colleges, departments, and non-academic units within the institution. The department is responsible for the development of computer systems to support the operational requirements of the university. Over the past several years the department has expanded its role and has initiated an office automation service for administrative units.

The current hardware configuration consists of an IBM 3081D running MVS/SP 1.3.2, 56 logical spindles of 3350 type disk, 8 tape drives, and two Xerox 9700 laser printers. CICS is used as the teleprocessing monitor for all on-line transaction processing with the communications network consisting of approximately 460 3270-type devices, running under VTAM and SNA. Communications are provided through a University owned campus wide broadband coaxial cable network. This network is capable of simultaneously carrying a large number of high quality video, audio, and data signals, and extends to the majority of buildings on campus. Use of the network is shared between the instructional television system, the physical plant energy management system, the academic computing center, and AIS.

The initial entrance for the department into the area of word processing and office automation came in 1980 when a pilot project was initiated for the administrative units of the university. This pilot was implemented using equipment from Four-Phase Inc. and consisted of a total of two system units, 50 workstations, and 30 printers. The functions provided as part of this project were limited to text processing and the ability to access the CICS network through 3270 emulation. No provisions were available to transmit documents between the two systems. In 1983 the decision was made to conduct an evaluation with the intent of establishing an administrative office automation network.

Office Automation Issues

In attempting to define the requirements for an office automation network several groups of functions were identified outside of the requirements for text processing. These requirements were grouped under categories of connectivity and communications, electronic mail / document distribution, and host integration. These requirements are summarized below along with several related issues and concerns.

Connectivity and Communications

- All devices and types of workstations must be supported under a single network. It appeared that each vendor, or market segment was attempting to provide networking capabilities among similar devices. Numerous networks have appeared on the market to connect various type of personal computers, similar networks have appeared for mainframe systems and dedicated word processors. The objective must be to install a network which would support a wide variety of devices.

- The network must allow the end user the widest possible selection of workstations. In order to provide for a workable document distribution and electronic messaging system, the network must have the potential for reaching as many users as possible. This would include:

  a. The existing network of 3270-type terminals. These terminals represent an existing investment which ought to be preserved. These terminals must be capable of participating in all functions provided through the network.

b. Most academic units are connected to the academic computing system, through a network based upon ASCII terminals.

c. A number of departments, both academic and non-academic, have previously installed stand-alone word processing systems.

- * Concurrent with this planning, the academic computing center was also in the initial planning stage for the development of a campus-wide network based on local area network technology. The office automation network would have to provide a gateway for access through this network.

- * The network must preserve the integrity of any information interchange among a variety of workstation types. The content of documents must be interchangeable between device types without the lose of the formatting characteristics assigned by the original author.

- * The network must be able to offer similar functions from all device categories. This would include same/similar operator interfaces.

- * Support for the attachment and utilization of the IBM Personal Computer, or a plug-compatible equivalent, as a fully functional word processing work station must be included. This would include the ability to transfer data between the personal computer diskette and the word processing system.

Electronic Mail / Document Distribution

- * The system must allow both direct system-to-system cable connections and dedicated remote communication using the MSU broadband coaxial cable for purposes of document distribution.

- Technical communication and routing functions must be transparent to the standard work station user. A standard work station user must be able to initiate document distribution to one or more users located on any connected or communication system by specifying either a distribution list or user name and system name only. The operator must be able to distribute a single document to multiple users from a single distribution request using a distribution list technique. All communications and routing requirements to effect the distribution must be automatic and transparent to the user.

- The system must support automatic document distribution and must include optional user priority specifications, time of day transmission, and quantity trigger levels.

- The originator of a distributed document must have the option of requiring automatic system generated conformation of receipt and disposition messages from all recipients of the document.

Host System Support and Integration

- The host software system must be an IBM Customer Information Control System (CICS) application.

- The host software system must provide centralized library/archival support of fully-editable files (e.g. records processing) and text documents created on the word processing/office automation system. From any word processing work station a user must be able to store, retrieve, and delete documents from the host system. This facility is intended to minimize and/or eliminate the requirement for individual system backup operation of user text and file documents for recovery purposes.

- User specified searches of the host document library must be supported. Search criteria must include document name, creation date range, document originator, and out-of-context keywords support as a minimum.

- The host based system must provide security capabilities that allow both document access control and user authorization specifications.

- The host software system must provide application programming interfaces that will allow CICS transactions to be developed which would store, retrieve, and delete documents or files contained in the host document library.

- The host software system must provide work station users the ability to format and initiate document printing on host attached printers.

- The host software system must provide workstation users the ability to submit S/370 batch jobs for execution.

- The host software system must provide work station users the ability to convert documents and input them to the IBM STAIRS product.

The MSU Approach

In evaluating the various combinations of hardware and software available in the marketplace, MSU/AIS decided upon a combination of products offered by IBM. The host software chosen was the Distributed Office Support System (DISOSS) while the standard workstation was based upon the IBM 5520 Administrative Office System. These two products, along with several supporting and complimentary products form the nucleus of the MSU administrative office automation network.

The key to providing to providing connectivity is the DISOSS product. Distilled to its most simple elements, DISOSS is a host based electronic mail and document storage system. The value of DISOSS comes through its implementation of the IBM office systems architecture. This is a three layer architecture consisting of the Systems Network Architecture (SNA), the Document Interchange Architecture (DIA), and the Document Content Architecture (DCA). Together, these architectures permit the interconnection and information interchange between all of the IBM office systems. In addition, they provide a vehicle through which other vendors may participate.

The Document Interchange Architecture defines the rules for information interchange and provides for document control. This control take the form of destination information, handling instructions, and processing instructions. Like SNA, the DIA is content independent and will therefore allow multiple modes of information (data, text, graphics, voice, image) to be transmitted. The DIA services fall into three general categories: document distribution services, document library services, and application processing services. These correspond to the functions provided by DISOSS.

The Document Content Architecture defines the rules for specifying the form and meaning of document structures. Currently two forms have been defined: revisable form text and final form text

Revisable Form Text - Maintains intent of author throughout revision cycle(s), is independent of any product specific language, is structured for random access and update, and is formattable into a "final form" presentation for print and display.

Final Form Text - Often referred to as "print image", consists of the original text interspersed with controls and generated text, and the print fidelity preserved.

The Distributed Office Support System (DISOSS) is a comprehensive host-based system for document distribution, management, and security. The primary functions supported by this product include:

Library and distribution services for text and images.

Retrieves documents by name, date, author, recipient, class or key words.

Interfaces to STAIRS for full context document search.

Can index and provide search and retrieval for external documents that may be filed elsewhere.

Accommodates Scanmaster I image documents such as magazine articles, graphic illustrations, signatures, contracts, etc.

Provides access to S/370 services and resources.

The 5520 system provides the backbone for text processing. In addition it provides 3270 emulation capability for access to mainframe CICS applications and support for DISOSS. The DISOSS support provides the central library capability, access to host resources such as the 9700 laser printer, and the functions of document distribution and electronic messaging. Support for the IBM personal computer is included allowing the PC to function as a full-function workstation. In addition two sets of file transfer capability are provided for the PC. One set of file transfer programs allow the movement of data between the mainframe and the PC. This software is based on the 3270/PC file transfer program. The second set of file transfer programs provide for the movement of data between DOS files on the PC and documents/files on the 5520 hard disk. This file transfer may be used either to move text (revisable form documents) or binary data. This opens possibilities of using either the 5520, or the host, as a backup device for the PC.

Furthermore, the ability to move binary files opens the possibility of moving Lotus spreadsheets (or other uniquely formatted DOS files) between PC's through the 5520.

In order to extend the office automation functions to the existing 3270 network a third component was added to the plan. That was the DISOSS/Professional Support package. This package runs as a CICS application using the Application Programming Interface (API) of DISOSS. DISOSS/PS allows 3270-type terminals to participate the document distribution / electronic messaging functions, and provides a limited text editor to allow entry of text directly into the DISOSS document library. With this package, any terminal which can access the CICS network can participate in the DISOSS network. To incorporate personal computers not directly attached to a 5520 device, requires that the PC have a some form of 3270 emulation support. A second option under investigation is the use of a protocol converter to allow any ASCII terminal (or personal computer) to participate in the network.

In addition to the above mentioned software, several other packages have been added to further expand the services available through the network. Closely related to the DISOSS/PS product is another IBM offering, the Personal Manager. The Personal Manager package provides addition support for an office environment and can be incorporated into the DISOSS/PS menus. The functions provided in this package include: personal, group, and conference room scheduling, a telephone message log, a sign-out record, and a project notebook (to-do lists).

To provide enhanced use of the Xerox 9700 printer, the Xerox Integration Composition System (XICS) was acquired. This package allows the creation of complex highly stylized documents, which previously would have required typesetting. Coupled with the high speed printing of the 9700 printer, this provides a facility for high quality, large volume print output, without requiring the use of a relatively slow word processing printer.

To provide additional text entry capability, the IBM PC word processing package PCwriter was added to the plan. This package presents an operator interface very similar to that of the 5520 system. Documents created with PCwriter may be converted to standard revisable form (through a function included in that program) and then moved to a 5520 system with no lose of formatting characteristics. This allows documents to be removed from the system, edited or revised on a stand-alone PC, and the returned to the DISOSS network through the 5520.

What has been described is the implementation strategy as of July 1984. During the Fall of 1984 IBM has announced a number of other extensions to the office products family. In addition, several other word processing vendors, and at least one PC based software vendor have announced their intentions to support DISOSS and the DIA/DCA architecture. The next section will briefly discuss the current status of the implementation.

MSU Current Status

In October 1983, installation of the IBM 5520 Office Automation Network began as a replacement of the Four-Phase Word Processing Systems. Since that time, it has expanded considerably and presently consists of six system units installed across campus, with 120 workstations and 37 printers attached.

The initial offering for workstations has been the IBM 5520 Administrative Office System. The workstations can be either dedicated 5253 display devices, or IBM-PC's attached using the 5520 emulation hardware and software. This initial offering provided 3270 emulation capability through the 5520 along with document distribution to other 5520 workstations. The facilities of DISOSS offered in the initial offering were the library services (archive, search, retrieval, and deletion), and a limited form of printing on the host-attached Xerox 9700. The print services available were limited to a single typestyle on a single paper stock. A total of nine different typestyles were available and included 10-pitch, 12-pitch, 15-pitch, and proportional fonts.

As of the present time the status of other aspects of the plan are as follows:

> The implementation of DISOSS/PS is still under evaluation. At the current release there are limitations in the movement of text between DISOSS/PS and the 5520 systems.
>
> The Personal Manager package was placed on order late this fall. It is expected to be available as a pilot project near the end of the first quarter 1985.
>
> This initial release of the XICS interface has been completed and will be available first quarter of 1985.
>
> The PCwriter package has been in use for several months. As a side note this paper was originally prepared using PCwriter and then transferred to a 5520 system for final printing.

Summary

This paper has attempted to demonstrate how the IBM family of office products can be utilized to (1) provide extensive office automation / word processing support to a wide range of device types while (2) preserving the existing investment in communications networks and terminal equipment. The information presented here is by no means an exhaustive description of the possibilities, and probably ignores many other equally plausible alternatives. The strategy presented represents efforts of the AIS Department at MSU to provide a solution for the particular requirements for our institution.

A SYSTEMS APPROACH TO OFFICE AUTOMATION BY

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Increased productivity and greater efficiency can be realized from office automation if employee participation is designed into the systems development cycle. In this paper a methodology for the progressive development of office automation is described. Techniques which encourage participation by users are illustrated. A survey questionnaire is presented and its use to identify word processing features required to satisfy needs are explained. Vendors demonstrated the ability of their hardware and software to meet performance specification derived from the survey. The analysis techniques, both quantitative and subjective, and factors considered in evaluating the vendor products are described.

INTRODUCTION

One of the fastest growing areas in today's business environment is the use of computers and word processors in offices. Although the introduction of technology in the office does not in of itself constitute office automation, it is a major factor. We generally accept office automation to mean machine aided methods and procedures for performing those tasks normally found in a business office.

Figure 1 indicates that the automated office not only includes the capability to do word processing, but also provides functions which are used at each level in the organizational structure. At the office operating level word processing saves time secretaries can help set up meetings, messages can be distributed, and other efficiences may be realized. At the mid-management level, office systems provide input for planning, calculations can be performed, management and technical information can be shared. At the executive level, office automation encourages the exchange of information, provides for time management, appointment scheduling, and coordinating plans. With the appropriate communications, access to data bases and information required by different offices becomes available. Facsimile transmission could offer some savings in a multi-campus environment.

Although access to information and sharing resources are inherent in office automation, privacy must be maintained. In a system that involves the mainframe, this implies the need for special procedures, password protection, or other safeguards.

CENTRAL MICHIGAN UNIVERSITY BACKGROUND

An Office Automation program started at Central Michigan University two years ago. At that time, the computer committee observed that hardware and software were being acquired by individual offices for use in word processing. It was clear that the offices were attracted by the savings and efficiencies offered by word processing in internal operations. However, little attention was being given to obtain the advantages of integrated systems and planned growth. The proliferation of individual systems is perceived as a "penny wise, pound foolish" approach. In other words, the expenditure for an office may have been wise, but it did not benefit the university as much as some other purchase could have.

After the first study of word processing was completed, (i.e. 2 years ago), recommendations were made to implement systems which met standards. One objective in the initial study was to encourage the purchase of compatable systems. The second study attempted to move from stand alone word processing to Office Automation. The administration recognized that there was a need to maintain standards. At the same time, the rapidly changing technology urged caution lest we be constrained by an inflexible system. Techniques and procedures which would provide backup and integrate computer resources needed to be examined.

In the university environmnent, it quickly becomes apparent that office automation impacts both academic and administrative functions. In both branches specific problems emerged, including:

1. Word processors and microcomputers of different brands, makes, and models persisted in offices.
2. The number of requests for word processing equipment and microcomputer equipment was growing. Although justification to purchase equipment was required, the initial arguments were frequently specious.
3. Equipment seemed to be acquired without regard for a total plan for office automation.
4. Maintenance was appearing as a problem with increasing frequency.

In the development of automated offices, word processing has had the greatest impact. Studies have shown that about 40% of a secretary's time is consumed in typing. This was confirmed by a small sample on campus. In the office environment where large volumes of repetitive letters, form letters, promotional material, articles for publication, and examinations are produced, the word processor is much more than a typewriter replacement. In the academic offices as well as the administrative offices, there are many documents which require editing, revision, and minor alteration. The capability to change format and introduce new text into a document is a welcome reprieve from the tedium of retyping.

The proliferation of computers for word processing extended to faculty who acquired their own systems. Ways to serve these faculty without incurring exorbitant cost presented a challenge in the planning process.

Concurrent with undertaking the office automation study was the commitment of the university to install a completely new telephone system. It was expected that the new telephone system could be used to enhance the total office automation capability by improved communications. However, it was assumed that the conversion was not to be a major factor in the short range plans.

GENERAL STRATEGY

Figure 2 sketches a total strategy that one might consider in an overall plan. The strategy involves recursive examination. The initial analysis involves assessing the existing state, defining where you want to be, when, and within what constraints. Especially important in the MACRO study is the establishment of broad agreements. It generally is expected that a consequence of an integrated office automation system is improved productivity and greater efficiency within a cost effective environment.

The MACRO study provides the modus operandi for:

- Identifying the current status of automation (e.g. hardware, software, peopleware)
- Identifying who has needs and what the needs are (e.g. clerks, executives)
- Identifying resources that will be required to implement a system (e.g. technical expertise, money)
- Identifying the information flow (e.g. correspondence, database profile).

Phase I tasks include formation of a responsible team, exploring a number of feasible approaches, investigating how equipment is used and how personnel expend their efforts, analysing administrative and office functions, and reexamining problems involved in planning, training and implementation. Management concurrence with initial concepts should be confirmed. At Central Michigan, management supported this planned approach and participated in its implementation.

Phase II calls for improvement for the existing system. In a generic sense, a functioning organization has an office automation system in place. It may be neanderthal in nature, but it serves a purpose. Improvement of the system involves introducing a higher degree of technology, or possibly making better use of technology which has been implemented. This implies:

- Assessing hardware and software performance
- Identifying service provided (e.g. what offices, to whom)
- Assessing vendor support (e.g. checking that service and performance are as advertised)
- Evaluating personnel participation (e.g. learning to use equipment, attitudes)

The challenge was to be responsive to word processing needs and to integrate resources to attain symbiotic advantages. To do this, it was necessary to standardize on compatable equipment. One approach is to make available special equipment such as terminals from which word processing resources might be shared between several offices. This equipment exposes users to some of the special functions that are available on word processing machines.

Understanding people and their attitudes is a fundamental requirement for conducting a successful program. The approach selected at CMU might be described as participative management. All levels of users contributed to the study. Equally important is the feedback that they received. Implicit through this phase is management participation and concurrance in approaches and procedures.

Phase III manifests the dynamic movement toward true office automation. Changing technology and restructuring of the organization within a university may have a major impact during this phase. Features that might be added to enhance the system include distributed word processing, distributed text processing, the use of electronic mail, sharing information from the mainframe computer, and the introduction of electronic filing.

Phase IV evolves as an expansion and review phase. The introduction of more sophisticated capabilities to enhance the system appear. Advances are made in the use of calendar management, electronic blackboards, graphics, database, and shared resources. In this phase there is an increase in direct use by management. Extended capabiliies include the introduction of higher level features of office automation typified by direct voice entry, teleconferencing, document transmission, remote graphics, call back, note pads, the addition of decision support systems, and the capability to accomodate members of the staff who may have to work out of their homes.

The final phase of any system life cycle represents maturation, which, in fact, reduces to a feedback mechanism for improvement as technology changes and progresses.

CMU PROJECT

At CMU the groundwork for phase I had been established. A committee was appointed and charged with the responsibility of reporting at the end of six months. During its first meeting the committee selected a chairman, clarified the project objectives, the scope, goals and constraints. Within the first three weeks a project plan was devised and a methodology for performing the study and arriving at conclusions was developed. A preliminary time schedule for performing the overall task was developed. This time schedule included tasks such as specifying the objectives of the study, clearly redefining problems, assigning people to specific functions, and arranging for support. Based on the review of the defined objectives and problem definition, the time schedule for accomplishing the remainder of the tasks was established.

As a result of the very preliminary study, it became clear that a total office automation analysis could not be completed by the group within 6 months. Instead, it was agreed to restrict the study to selected administrative offices and at the same time to keep in mind possible expansion to other offices. Figure 3 shows the outline of the project plan that was adopted. It indicates the key tasks that should be performed and relative time scales during which they can be accomplished. In order to conduct the study, the committee identified areas in which each member could contribute. Tasks were then defined for each member.

The objectives of the study were codified and incorporated in a memorandum to all offices that might be affected by the recommendations resulting from the committee's work. In addition, the memo solicited the cooperation and assistance of representatives of the various offices in helping to assess need, as perceived by employees, and expectations from an office automation environment.

In addition to input from administrative offices, faculty input was solicited. A survey of 126 faculty revealed that word processing was the major use of microcomputers by more than 90% of those responding. The exceptions were primarily faculty in the technical disciplines and in accounting. Faculty expressed a desire to be able to interface with both mainframe and microcomputer equipment on campus.

A new Northern Telecon Telephone system was about to be installed. The committee recommendations reflected recognition of the potential provided by the new communications system. Features such as networking, voice messaging, and asynchronous protocols were considered important.

To establish a base, the committee acquired a list of exisiting word processing equipment. This include location of the hardware, prime user, when acquired, and a description of the configuration. Not only was the equipment identified by type and model, but information was gathered to establish how the equipment is used, by whom the equipment is used, and how much the equipment is used.

Organization charts and office locations were correlated to identify areas of mutual interests. The committee discussed some of the problems that one is apt to encounter in designating different types of equipment and software as standard. The necessity of distinguishing between stand alone word processing equipment, portables, microcomputers with word processing packages, and shared systems was anticipated. For some functions the main frame could provide a word processing capability through terminals and a printer.

During the preliminary analysis, the committee decided to gather information which could be used to identify functional and performance parameters. Figure 4 shows the questionnaire that evolved after several iterations and pilot tests. Respondents were classified as hands on word processing users, hands on users for both word processing as well as file manipulation and computer, not a hands on user but provide input, and those who do not have a computer or word processor available. Users were asked to identify by brand and model the unit on which they worked. Thirty-eight functions and characteristics of word processors were listed. Respondees were asked to provide information which indicates the importance of the feature to the respondee, frequency of use, ease of use, and availability of the feature.

The first form of the questionnaire was distributed to a small sample group of 15 persons. The people in the group were encouraged by their supervisors to cooperate. In order to make them feel like members of a team, they were furnished documentation describing the function of the committee, its goals, and the relation of the study to their work.

Respondees were asked to make suggestions for improving the questionnaire and its acceptability to their peers. As a result of the responses and discussions several revisions were made to the questionnaire. The revised questionnaire was distributed to one hundred-seventy individuals from whom 112 useable returns were received.

The replies of 66 "hands on" users were sorted and tabulated using SPSS. This is shown in Figure 4. For example, the entry in column 1 for question 1 states that 58 people with hands on experience feel that the ability to create and store a document is indispensible. In column 2 we learn that 65 people in this group currently have the feature on the equipment that they are using. The entry in column 3 tells us that 47 people in this group use the feature in more than 1/3 of their work. The entry in column 4 reveals that 61 of the user group consider the feature easy to work with.

Correlations between columns provide insight as to how users generally reacted. The raw data suggest that a high percentage of the users working with a feature generally consider that feature to be indispensible.

The last five questions on the form were intended to furnish data which could be used in planning. The replies were sorted by rank, responsibility, and department as indicated in the heading to the questionnaire.

Invitations were sent to several potential vendors to demonstrate their capabilities on campus using software compatable with their hardware. Vendors were informed that they were exptected to demonstrate certain word processing features which had been identified by the survey as indispensible. In addition, vendors were to demonstrate the ability to communicate with the Sperry 1100/70 via 3270 and 3780 protocol. This included uploading files, downloading files, and transaction processing. Vendors were provided a sample of the file that could be used to demonstrate downline loading. In addition, vendors were provided with a copy of the evaluation from which would be used and were told how the survey related to it.

Vendors who elected to participate furnished a list of specific software packages that their system supports, a description of the software that was to be used in the demonstration, and the operating system. Nearly all vendors suggested that they would show expansion features. The order in which the functions were demonstrated varied.

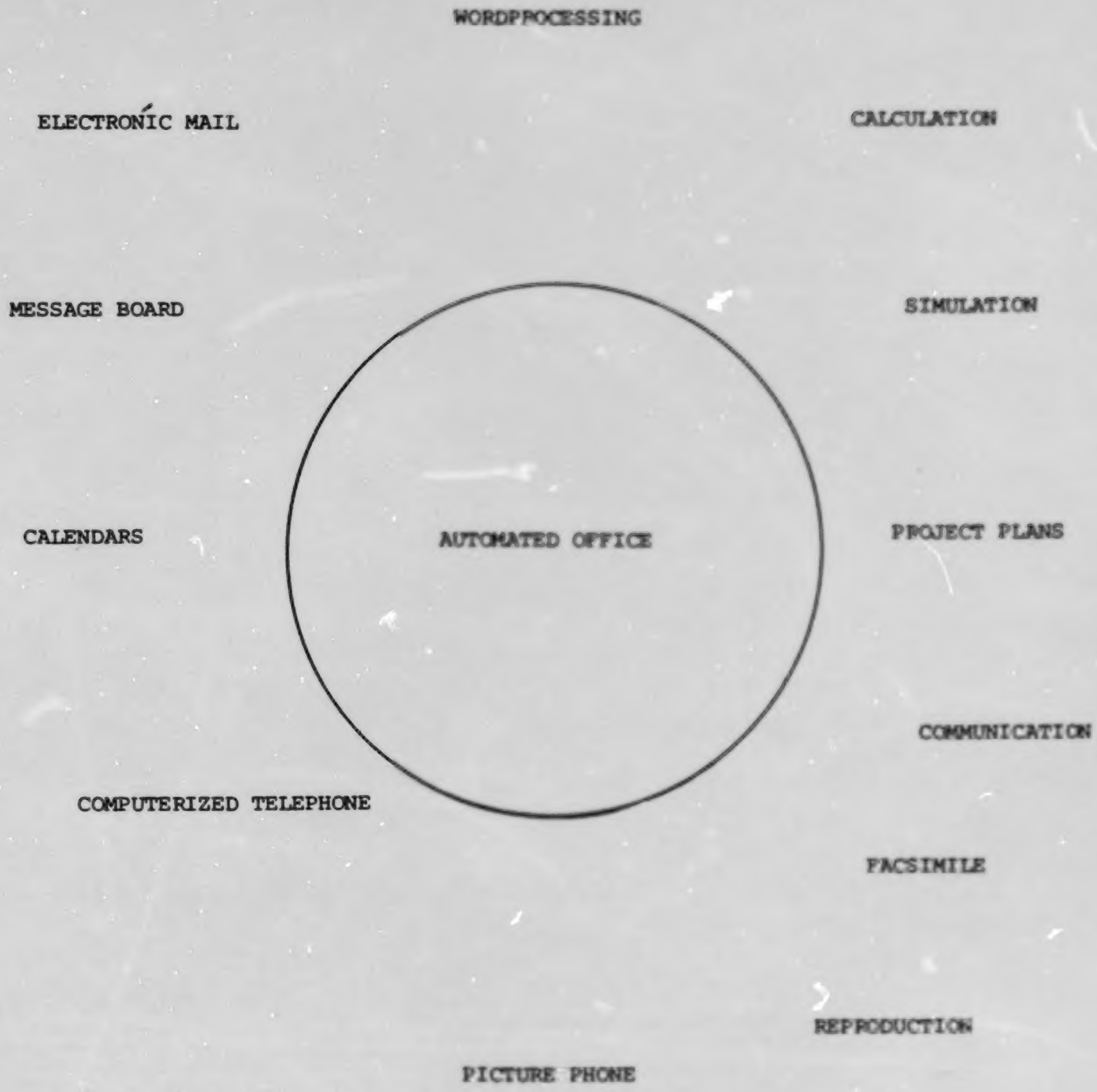
Several specialists from computer services were invited to join the committee in the evaluation. Each evaluator was provided with an evaluation form which listed the features that wold be demonstratred. Figure 5 shows the first page of the form. The number of key strokes required and use of special function keys were intended to indicate the degree of difficulty for accomplishing a task. Overall score reflects an evaluator's impression. The form also provided space for comments and vendor data. CMU personnel operated some of the equipment so that evaluators would not be influenced by a skilled performer. Seven vendors completed the demonstrations. These were ranked by the evaluators independently on a subjective basis. Figure 6 shows the ratings that were obtained. There was a high degree of consistancy in the ranking assigned by the rators. However, analysis of the difficulty of performance did not reveal any significant differences.

Specific conclusions derived from the study are summarized as follows:

1. Standardize on several brands and types of equipment. The advantages of standardization include discounts in purchasing, available backup equipment, ease of training personnel, affective support and maintainance, and potential expansion.
2. Software packages used by the majority of departments on campus should be transferrable between machines. this implies that although compatability is important, it need not be total to satisfy functional needs.
3. Special needs exist in some areas. These should be supported.
4. Centers where faculty could bring their disks for printout would provide a useful service.

The problems that motivated this study are not unique to Central Michigan. The methodology used, and techniques developed to encourage input at all levels is adaptable to many other problems in other environments.

This study would not have been effective without the cooperation of many people. In particular, the author wishes to recognize the other members of the committee: D. Gust, J. Ball, J. Greenlund, J. Bissel, D. Schock and G. Hartman.


WORDPROCESSING
ELECTRONIC MAIL
CALCULATION
MESSAGE BOARD
SIMULATION
CALENDARS
AUTOMATED OFFICE
PROJECT PLANS
COMMUNICATION
COMPUTERIZED TELEPHONE
FACSIMILE
REPRODUCTION
PICTURE PHONE

AUTOMATED OFFICE

FIGURE 1

PHASE I - INITIAL ANALYSIS
MACRO STUDY

PHASE II - IMPROVEMENT
TECHNOLOGY
PEOPLE-OLOGY

PHASE III - INTEGRATION
SHARED RESOURCES

PHASE IV - REVITALIZATION

TOTAL STRATEGY

FIGURE 2

PROJECT TITLE STUDY	PROJECT STATUS SYMBOLS ○ Satisfactory ☐ Caution △ Critical	PROGRAMMER/ANALYST			
	PLANNING/PROGRESS SYMBOLS ▭ Scheduled Progress ▬ Actual Progress	V Scheduled Completion ▼ Actual Completion	COMMITTED DATE	COMPLETED DATE	STATUS DATE

Activity/Document	PERCENT COMPLETE	STATUS	OCT.		NOV.			DEC.		PERIOD ENDING				MAR.						
			5	19	2	16	30	14	28	9	23	6	20	6	20	27				
1. PROJECT SCOPE			▭																	
2. DEFINE OBJECTIVES				▭																
3. PROBLEM DEFINITION				▭																
4. ANNOUNCE TEAM			▭																	
5. TIME SCHEDULE			▭	▭																
6. SYSTEM ANALYSIS					▭	▭	▭	▭												
7. ANALYZE RESULTS							▭	▭	▭	▭										
8. IDENTIFY BASIC NEEDS										▭	▭									
9. VENDOR DEMOS											▭	▭	▭	▭						
10. ANALYSIS OF DEMOS														▭	▭					
11. FINALIZE RECOMMEND.															▭	▭				
12. REPORT RECOMMENDATIONS																▭				

PROJECT PLAN

FIGURE 3

BEST COPY AVAILABLE

Name________________________ Title________________________ _____

Building____________________ Department____________________ Room__________

This survey will be more meaningful if it reflects your perspective as a user. Please indicate your perspective by writing an X next to the most appropriate statement.

1. I am a "hands on" word processing user 35
2. I am a "hands on" file manipulation and computer user 14
3. I am a "hands on" user for both the above 17
4. I am not a "hands on" user of computers or word processors, but I provide input 25
5. I do not have a computer or word processor available 31
6. If you have an available unit, identify it by brand/model __________

For the functions or characteristics listed below. (If you responded with an X to the preceding statements 4 or 5, answer only column 1 below):

In column 1 please answer by inserting the letter:
"a" if you find the feature indispensable
"b" if you would consider it desirable
"c" if you consider it unimportant

In column 2 please indicate:
"y" if you currently have this feature on the system you use
"n" if you do not have this feature

In column 3 please indicate how frequently you use this feature
"a" in more than 1/3 of my work
"b" in less than 1/3 of my work
"c" never

In column 4 indicate whether the feature is:

"a" easy to use
"b" complex

			a,b,c 1	y,n 2	a,b,c 3	a,b 4	
1.	Create and store a document	1.	58 a	65 y	47 a	61 a	
2.	Insert characters, words and sentences	2.	57 a	64 y	43 a	60 a	
3.	Delete characters, words and sentences	3.	57 a	64 y	44 a	60 a	
4.	Move a block of text	4.	53 a	62 y	29 b*	52 a	* 28 a
5.	Delete a block of text	5.	54 a	62 y	28 a*	55 a	* 28 b
6.	Center a line	6.	41 a	55 y	35 a	53 a	
7.	Number lines or paragraphs automatically	7.	23 b*	31 y	27 c	32 -	* 23 c
8.	Indent a paragraph automatically	8.	34 a	43 y	24 a	41 a	
9.	Search for a group of characters	9.	35 a	54 y	38 b	43 a	

QUESTIONNAIRE

FIGURE 4-A

BEST COPY AVAILABLE

			a,b,c 1	y,n 2	a,b,c 3	a,b 4	
10.	Automatically search and then replace/delete characters	10.	28a	49y	30b	37a	
11.	Page formatting with tabulation	11.	32a	41Y	20a	30a	, 29-
12.	Page formatting with right and left justification	12.	33a	45Y	25b	36a	
13.	Change the length of the text page	13.	43a	52Y	26a	44a	
14.	Change the margin settings	14.	52a	52Y	31a	43a	
15.	Reorganize document and renumber pages automatically	15.	34a	44y	21b	25a	
16.	Sort alphabetically or numerically	16.	28a	33Y	23-	39-	
17.	Save (or store) a file on diskette	17.	52a	54Y	37a	47a	
18.	Revise a file on diskette	18.	51a	49Y	33a	42a	
19.	Merge two files from the same diskette	19.	34a	41y	25b	31-	
20.	Merge two files from different diskettes	20.	28a	42y	21b	30-	
21.	Print a copy of a file onto paper	21.	54a	55Y	37a	50a	
22.	Print part of a file onto paper	22.	47a	49Y	29a	44a	
23.	Print only one type face	23.	22-	32Y	33-	35-	
24.	Print with superscripts	24.	24-	42Y	27b	33a	
25.	Print with subscripts	25.	25a	42Y	23b	33a	
26.	Print boldface	26.	32a	46Y	23b	41a	
27.	Print graphs and charts	27.	36b	32n	29-	51-	
28.	Underline a word or sentence	28.	44a	51y	32a	46a	
29.	Underline numbers in columns	29.	39a	49y	23b	38a	
30.	Professional typewriter quality output	30.	47a	47y	35a	43a	
31.	Download/upload to Sperry Univac (batch)	31.	25b	33n	35-	54-	
32.	Perform transaction communication (TIP) with Sperry	32.	21b*	30-	39-	54-	* 21-
33.	Display more than 80 columns on CRT	33.	21b	30n	34-	52-	
34.	Perform spreadsheet analysis	34.	26-	29y	30-	42-	
35.	Perform calculations while generating documents	35.	22a	31y	26-	39-	
36.	Perform the functions of a calculator	36.	27b	34Y	27-	40-	
37.	Provide calendars	37.	24b	33n	35-	61-	
38.	Provide electronic mail	38.	24b	31n	35-	56-	

1. Could your office share resources (e.g. printer, storage) with an adjacent office? Yes 19 No 35. Which office(s) ____________
Which resources? ____________

2. Could your unit share resources internally? Yes 36 No 14
Which resources? ____________

3. Would your unit benefit from having:

	Y	N	-
a. portable equipment (e.g. TRS100, KAYPRO)?	22	21	23
b. movable equipment or carts?	13	30	23

4. If you currently have a system, please identify any operations that you would like to be able to do, but can't.

5. Attach comments on any item not reflected by the survey.

QUESTIONNAIRE
FIGURE 4-B

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DATE:

VENDOR:

MACHINE:

SOFTWARE:

		Number of Keystrokes	Special Function Key	Overall Score
1. Create and store a document	1.	____	____	____
2. Insert characters, words and sentences.	2.	____	____	____
3. Delete characters, words and sentences	3.	____	____	____
4. Move a block of text	4	____	____	____
5. Delete a block of text	5.	____	____	____
6. Center a line	6.	____	____	____
7. Number lines or paragraphs automatically	7.	____	____	____
8. Indent a paragraph automatically	8.	____	____	____
9. Search for a group of characters	9.	____	____	____

EVALUATION FORM

FIGURE 5

VENDORS	RATINGS								AVERAGE RATING
NBI	1	3	1	1	1	1	1	1	1.3
SPERRY	2	2	6	2	2	2	3	2	2.6
ALTOS	5	5	4	4	5	5	5	6	4.9
CPT	6	1	2	*	3	4	4	5	3.6
BURROUGHS	*	*	3	3	4	3	2	4	3.2
Radio Shack	4	4	5	5	6	6	6	3	4.9
IBM	3	6	7	6	7	7	7	7	6.3

An asterisk indicates the committee member was not present for the demonstration.

SUBJECTIVE RANKING
FIGURE-6

Electronic Mail
The Door-Opener in Office Automation

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Dickinson College has been a leader in the use of electronic mail. The Dreams computer-based message system was first implemented in 1978.

This paper addresses several related topics:

The growth of electronic mail at Dickinson and how this was an integral part of the office automation effort;

The effects of electronic mail upon the office routine and the pitfalls to avoid;

The essential elements of an electronic mail system;

A presentation of some of the statistics gathered from the Dreams system at Dickinson.

Dickinson College has been fortunate to have people interested in electronic mail systems and willing to work on them on their own. Back in the late 70's when the early development of Dreams was occurring, the college could not justify making this activity a higher priority than such "minor" details as payroll, general ledger, and academic records. Nevertheless, Dickinson has been unusually well prepared to move into Office Automation due to the availability of the Dreams electronic mail system.

Before going much further, clarification of some terms seems appropriate. Dreams is the name given to an computer-based message system which runs on the Digital Equipment Corporation (DEC) PDP-11 computers under the RSTS/E operating system or on the VAX computers under the VMS operating system. It is not comparable to the commercial systems like MCI Mail which cover a wide area. Because Dreams was designed to be run within an organization on in-house hardware, there is no reluctance among users to send frequent, short messages throughout the day. As reported in the literature, at least 75% of all mail, electronic or otherwise, travels within the organization. Thus, even as an isolated system, a computer-based message system like Dreams can have a significant impact.

However, Dreams need not be an isolated system. Within any organization, Dreams will communicate over a DECnet network of computers. Special network handling software allows a user on a computer node to exchange messages with a user on a distant node almost as easily as local communications. At Dickinson, the small 2 node DECnet network of one PDP and one VAX utilizes this feature all the time.

Another opportunity to extend beyond a single system, at least for educational institutions, is via Mailnet, an Educom-sponsored network of colleges and universities. Dreams was one of the mail systems chosen to participate in the original project to establish the Mailnet network. This means that a college can join Mailnet for a nominal fee through Educom, acquire Dreams with the special Mailnet software, and immediately be tied in to a low-cost electronic mail network allowing communication with hundreds of colleges and universities in both the United States and abroad.

As stated before, early Dreams versions were developed in the late 70's. With terminals being rather scarce throughout the campus, but relatively plentiful within the computer center and in student areas, Dreams became a valuable tool and part of each day's activities only for the computer center staff and some students. In 1981 the "office automation" buzzwords were becoming more evident in the press so an analysis was done to consider how Dickinson might join this new activity. Stanford University's Decision Support System was one of the few academic projects in the area of office automation which was widely publicized. It appeared that four areas were being addressed: Electronic mail for administrators; a filing system for electronic mail; an electronic reminder system; and word processing.

It became apparent that the features of Dreams (as it had evolved over the years) could address the first three areas in varying degrees. The availability of good word processing software for the PDP-11 meant that for the cost of that software, Dickinson was in a good position to follow Stanford's lead on a smaller scale and still be able to set up a pilot project with elements of all four office automation activities. (Note: The DEC standard editor, EDT, although considered to be an excellent editor, was not considered of word processing quality for use in administrative offices. It was felt that either WORD-11 or DECword was appropriate for administrative word processing activities.)

These goals were incorporated into a proposal, along with other issues. In early 1982 Dickinson was awarded a grant by the Pew Memorial Trust which included funds for about a dozen terminals for administrative areas to allow the college to embark on an Office Automation pilot project.

With Stanford reporting that electronic mail was an extremely important component of their project and with Dreams having an enthusiastic group of supporters on campus, it seemed obvious that Dickinson's entry into Office Automation should emphasize what appeared to be its unique strength.

Between December 1981 and June 1983 terminals were added for the personal use of the President, his secretary, the Assistant to the President, his secretary, the Dean of the College, his secretary, the Associate Dean, the Assistant Dean, and the Off-campus Studies Office. This group of users plus several individuals within the computer center became the pilot project participants.

Each new user was first trained in electronic mail. Dreams can be very easy to learn and use in its simplest form. Sending messages to one's friends or colleagues is a non-threatening activity. It does not cost anything. The messages need not be serious. Electronic mail was the door-opener to other aspects of office automation. After a single instruction session, one on one, the new user could usually master the typical functions of sending mail, reading mail, deleting messages, and replying to messages. With this enjoyable activity of conversing with friends, people were learning the keyboard, the form of system commands, logging in and out, and all those things taken for granted by experienced users. Furthermore, since there were a few of those correspondents actually sending serious mail, the realization that Dreams could really be helpful was slowing sinking in. Gradually the frivolous mail decreased and the meaningful correspondence increased.

During this same period the number of terminals for the entire campus more than doubled from less than 50 to over 100. Accordingly, the attractiveness of electronic mail and word processing increased simply because of the improved availability. As the success of the pilot project became apparent, faculty and administrators would list access to the electronic mail system as a primary justification for a new terminal.

The next step was to train the new user in word processing. Again, most training was one on one. Although only incidental to this paper, the word processing aspect of the pilot, as well as the electronic mail aspect, was considered highly successful.

In the spring of 1984 another major expansion was initiated. After struggling with the typical microcomputer issues for most of the academic year, the Computer Services Advisory Committee, with heavy computer center representation, developed a plan for introducing micros to the campus. The DEC Rainbow was chosen to be the campus standard, in part due to an attractive single purchase discount. The Samna Word II word processor was chosen as the standard for that category of software. The committee recommended that the college purchase Rainbows for all faculty who want to use them. The committee reviewed the requests and assigned the first round of acquisitions. Over a six month period the college has gone from a handful of micros to over 100. Unfortunately, only about 20% of the new Rainbows have the ability to connect to a central system. This is a situation which will be improved as funds allow. Nevertheless, the use of the Dreams electronic mail continues to increase.

The Impact of Electronic Mail

Electronic mail is often cited as a time-saver. Eliminate or reduce those phone calls. Send fewer memos. Of course, this is true. But, what the promoters do not think to point out is that electronic mail is a brand new form of communication with its own unique characteristics.

The ability to dash off a note to someone a moment after an idea occurs promotes short, concise, frequent, and incomplete messages. On the plus side, this is more communication than without electronic mail. People are more aware of what their co-workers are thinking. On the minus side, resolving a question may take several days. Everyone comments, the messages get longer, new ideas are introduced, finally the issue is resolved. If it had been possible to get everyone together in a room, the whole matter could have been resolved in a half hour. On the other hand, electronic mail eliminated the need for a meeting.

The fewer people involved, the more likely a matter will be resolved quickly. A quick exchange of about 4 messages can easily occur in a morning between people who have made electronic mail a part of their routine. Here, one can argue, electronic mail has been a real time-saver. These exchanges do take place frequently and help make users into enthusiastic promoters.

What about the messages themselves? In general, electronic mail messages are written more carelessly than memos. There is an expectation that the receiver will read the message and delete it. There is no permanence. This certainly accounts for the vast majority of messages, but people tend to forget that it is a quite simple matter to print one's messages either as a group or singly. A certain camaraderie even seems to build up. The receiver of a message has the realization that certain messages just should not be printed. It is almost a duty to delete potentially embarrassing mail. The receiver doesn't want to betray the trust of the sender.

This brings up another characteristic. Electronic messages can be brutally frank. In the privacy of one's home or office with no one around, it is quite easy to pour out one's feelings in a message. It's not really a letter. There is no live conversation where the sender might be cut off by another conversant, or simply feel shy about expressing his feelings. It is so temptingly easy to "say it all."

Novice users tend to have wordy, rambling messages often filled with misspelled words. Isn't that a sweeping generalization? Yes, it probably is, but it seems that the more experienced user knows all about how to use the editor. For them, it is a simple matter to correct spelling errors, rearrange paragraphs, and make sure the words don't spill onto the next line. It may not be possible to identify whether the sender is experienced just by examining a message from them, but it certainly is possible to identify the sender to be inexperienced if the message shows obvious formatting problems.

One of the most interesting characteristics of this communications medium, which never before existed, is the "flaming" which frequently occurs. Flaming has come to describe the phenomenon of being impolite or even crude in electronic mail correspondence (especially now that the New York Times has used the term in an article on this subject). It seems that it is so easy to express exactly how one feels, without having to face the receiver, that messages sizzling with insults and obscenities are a new reality to be dealt with. It may not be possible for a manager of a department to control this behavior, since it has been reported that managers are sometimes the worst offenders. It has been suggested that those who flame probably send their messages immediately after deciding to send a message. There is no time to ponder and reflect the impact. There is no typing of a draft memo. Similarly, a person who immediately replies to his incoming mail may be more likely to flame since his reactions will have no time to cool down.

Characteristics of an Electronic Mail System

For an electronic mail system to be widely used in an organization it must have a set of minimum functions and be easy to use. The ease of use aspect is often accomplished via menus or a consistent set of commands. The only requirements of the message sending function which seem to be essential are the following:

1. Allow the sender to specify a group of receivers in addition to a single receiver.

2. Provide a method for the sender to determine the proper electronic address of the recipients.

However, most systems offer additional features. Since Dreams offers a rather long list, it will be used as an example. With Dreams the sender of a message has the ability to do any of the following:

Specify types of receivers, such as those on the CC (carbon copy) or BCC (blind carbon copy) lists, as well as the list of people to whom the message is to be sent.

Refer to groups of receivers by names familiar to the user, such as Staff, Us, Chief, Ginny, etc.

Enter a text editor at any point in the message preparation process.

Incorporate an existing text file into the message being prepared at any point (without entering a text editor to do so).

Change the receiver list at any point prior to actually sending the message.

Ask the mail system to hold the message until a certain date before sending it to the recipient.

Ask the mail system to send you an acknowledgement that the receiver has read your message.

Set a date after which the message will expire if the receiver has not yet read it.

Ask the mail system to send you a notice informing you that your message expired without the receiver ever reading it.

If, after sending a message, you reconsider the wisdom of saying such things, you may retract the message provided the recipient has not yet read it.

The message reading function has a few more "musts." For a mail system to have a chance of gaining in popularity, the user should be permitted to do each of the following on a per message basis:

1. Delete the message.

2. Answer the message or send a new message without an annoying hierarchy of menus/commands before reading the next message.

3. Keep the message.

4. Print the message.

5. Obtain a directory of messages.

Once again, to indicate the wide range of enhancements which can be added to the message reading function, many of the Dreams features will be listed briefly:

On a per message basis, the user may identify priority messages, store mail in auxiliary mail files (like another drawer in a file cabinet), or suppress the message until a certain date at which time it will reappear as a reminder. Rather than limit the receiver of mail to only one way of replying to a message, Dreams allows Forwarding with or without comments, as well as Replying with or without a copy of the original message being returned to the sender as a reference.

The user has great flexibility in navigating through his mail. Messages may be selected by comparing the date the message was sent to a given date. The options of Before, After, On, and Today are among the choices. Messages selected may be restricted only to those which have not yet been read, or vice versa. If some messages have been flagged as Priority messages, it is possible to select just that group. At any point while reading a group of messages, the user may ask for a directory of messages. By typing a message number from the list, he may go directly to that message. Another convenient aid is the ability to go back to messages already read or even already deleted. These recovered messages may be handled as if being seen for the first time. All of these navigational aids apply equally to auxiliary mail files.

Other convenient features are the ability to obtain an Inventory of auxiliary mail files and their subjects at any point, and the ability to suspend the message reading activity temporarily and execute almost any other system level commands which may help in formulating a reply to a message.

Dreams Statistics

The PDP-11 version of Dreams gathers a limited amount of statistics which can produce interesting insights. The first graph shows the number of messages initiated each day. It is easy to spot the weekends. The statistics were not recorded between early October and mid-November, but it is known that through the period, including weekends, the average number of messages initiated was about 140 per day. The sharp drop in late November was the Thanksgiving vacation.

The second graph applies to the same period of time and also refers to the PDP-11 Dreams. Each midnight a check is made to see how many messages are resident on the system. Furthermore, a count is made of the messages which have not yet been read. At Dickinson this remains relatively constant with about 3000 messages on-line with about 1300 of those being unread.

Graph 3 depicts the VAX Dreams usage from the date it was made the system standard. Prior to November 10, the VAXmail software was used by the general user. Usage rose quickly to a high of over 400 messages per day. The weekend before Thanksgiving was quite low with use never really recovering prior to Thanksgiving.

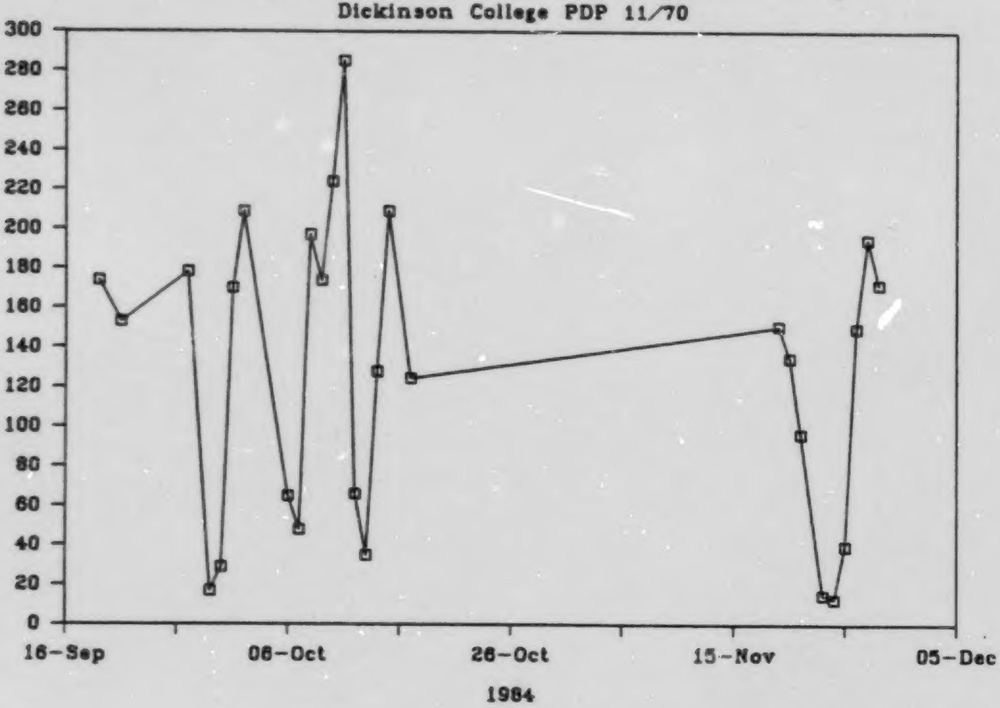
The VAX Dreams collects more statistics. Graph 4 shows some interesting observations. The top line graph (Copies/Msg) shows the average number of receivers of a particular message. Since the average is about 1.3, it shows that most mail is directed to a single person. A simple explanation would be that for every 10 messages typed into the system, only 13 people see them.

The lower line in graph 4 shows the fraction of the messages sent which included a copy of another message as a reference. Typically, this occurs when a user replies to a message he has received. Dreams will optionally return a copy of the message to the sender along with the reply so that the original sender can quickly recall what he had sent. It seems that about one-third of all messages include another message as a reference.

The most surprising aspect of these ratios is that regardless of the wildly changing patterns of usage in Graph 3, they are nearly constant.

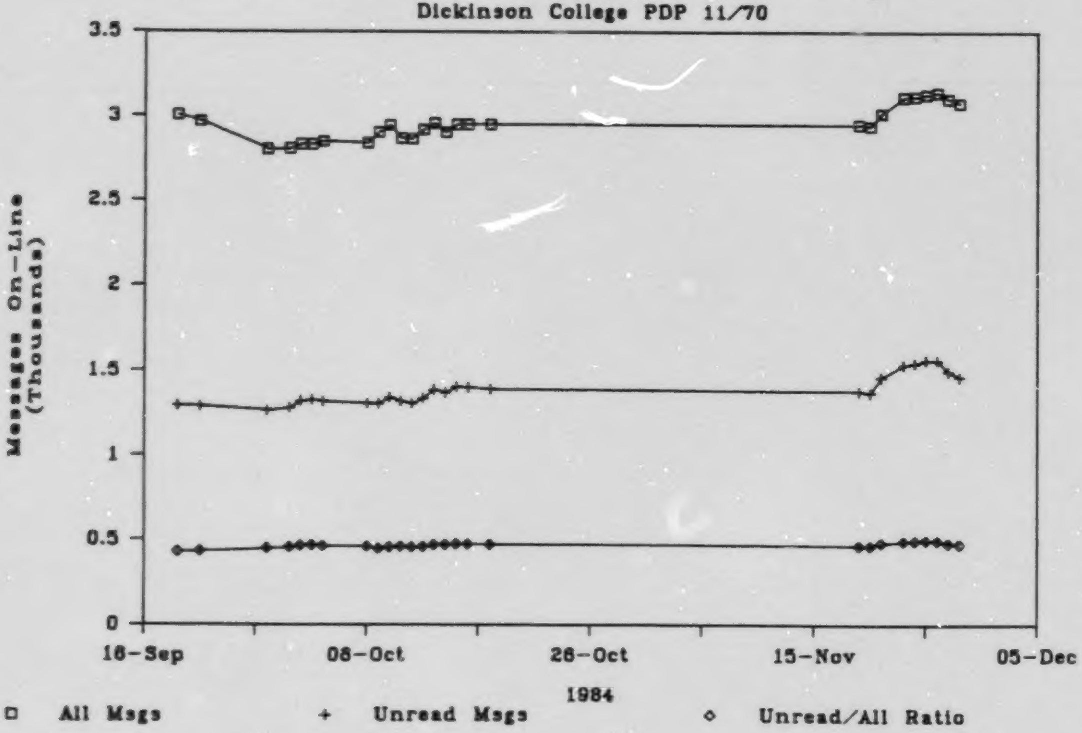
Graph 1: Messages per Day

Dickinson College PDP 11/70



Graph 2: Resident Messages

Dickinson College PDP 11/70



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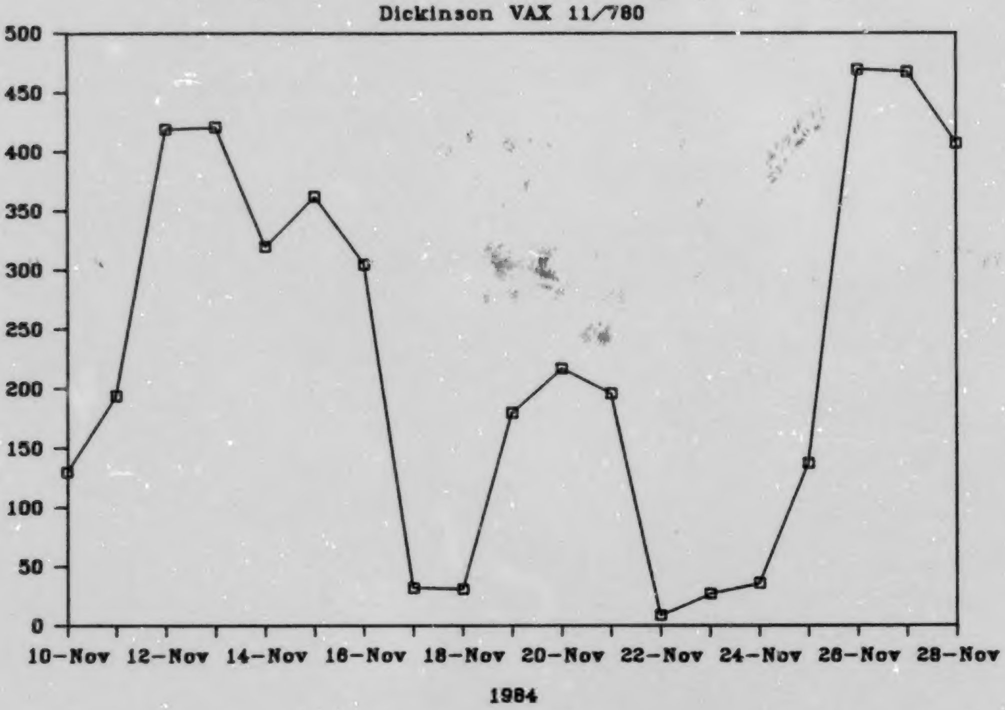
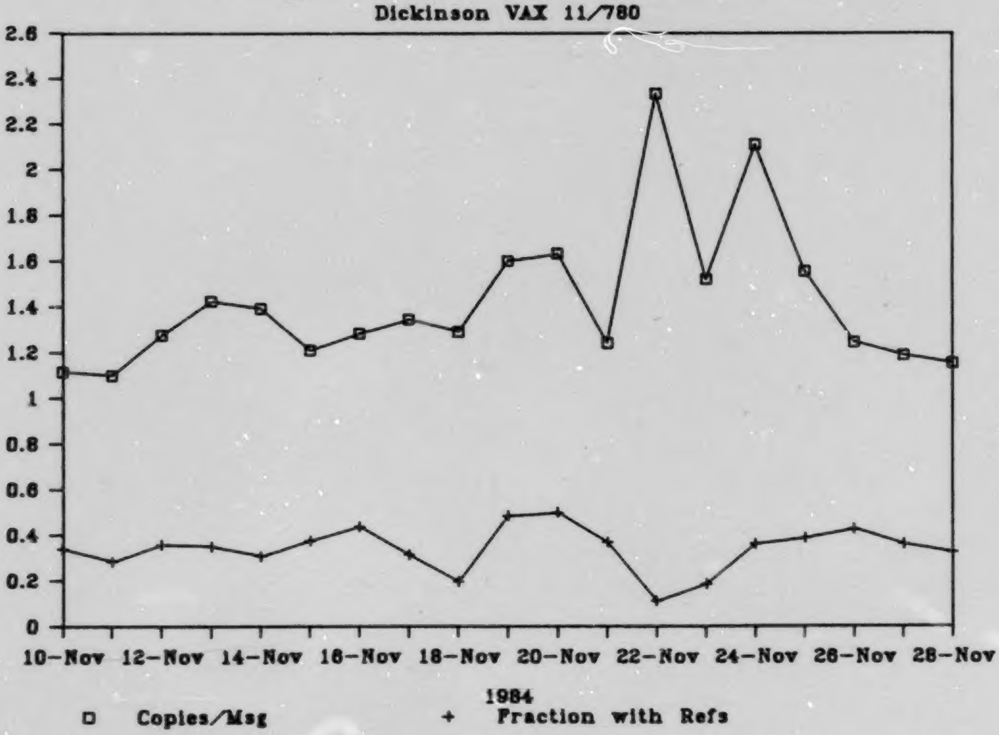
Graph 3: Messages per Day



Graph 4: Dreams Ratios



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PRODUCTIVITY COMPARISON BETWEEN POST-AUTOMATED OFFICE AND PRE-AUTOMATED OFFICE

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The purpose of this paper is to present the findings of a research study conducted by the author in the area of productivity measurement of a post-automated office and a pre-automated office. The paper presents the research methodology followed and the results obtained.

The methodology for the study consists of the following steps: equipment selection, operator selection, document types to be studied, data collection procedure to be followed, data collection and data analysis. The equipment selected consists of a IBM Displaywriter system which represents the post-automated office and a IBM Correction Selectric III typewriter representing the pre-automated office.

Among the four types of computer-based information systems, the Office Automation System (OAS) is probably the most widely used by and the most popular to office people. The obvious benefit of this system in office productivity has resulted in rising popularity of the system. This improvement in productivity is clearly noticeable in office documents which require editing to varying degree. Similar improvement is also accomplished in documents which require "straight typing". Significant amount of "straight typing" is carried out in offices.

The purpose of this paper is to present the findings of a study which was conducted by the author in the area of productivity measurement of a post-automated office and a pre-automated office. Specifically, the study was aimed at measuring and comparing, the productivities of these two types of offices involving "straight typing".

Before proceeding further, we need to define the term "productivity". Productivity, for the present study, is defined as the amount of time taken by an experienced operator, working at a normal pace, to produce a document of acceptable quality. An experienced operator is an individual who can type either 60 words per minute on a typewriter or 75 words per minute on a computer keyboard. A unit of document of acceptable quality is a document with no errors.

PREPARATION FOR THE STUDY

The preparation for the study consisted of the following steps.

1. Equipment selection: The equipments selected were a IBM displaywriter system which represented the post-automated office and a IBM correcting selectric III typewriter representing the pre-automated office.
2. Operator selection: Five experienced operators were selected to work with each type of equipment, thus a total of 10 operators were involved in the study. The experience of these operators ranged from three to seven years; all operators exceeded the minimum standards required of them.
3. Document selcection: Two types of documents were selected for the study. The first was a typed memorandum of one page (27 lines); the second was a narrative of 71 lines. Both source documents were typed documents.

DATA COLLECTION

The basic procedure followed for the study consisted of asking an operator to generate a specified document using a specified equipment and noting the time to generate that document. The time thus obtained included the set-up time (preparation time) and the actual time working on the document including error corrections, if any. The operator was instructed to review the document after typing for error detection and correction. The review time and the correction time were added to the time obtained earlier.

The same operator was asked to generate the other type of document using the same equipment.

The time-study was conducted for twelve weeks so as to obtain enough number of observations in each class to ensure statistical validity. An 80% confidence with ±10% accuracy was maintained for all data collected. Statistically, the times obtained from the operators using any specified equipment followed a normal distribution. Using the standard normal distribution table values, the following formula was arrived at to ensure the above stated confidence and accuracy levels.

$$N' = \left[\frac{13N}{\Sigma X_i} \sqrt{\frac{\Sigma X_i^2 - (\Sigma X_i)^2 \ / \ N}{(N - 1)}} \right]^2$$

where

N' was the required number of observations for statistical validity

N was the total number of observations taken so far

X_i was the value of each individual observation

As soon as N' was either equal to or greater than N for a document-office type combination, data collection for that combination was terminated.

The time-study was conducted during early-mornings, mid mornings, early afternoons and late afternoons to minimize the effect of operator fatigue on the data collected. Each operator participated in the time-study at various times during the day.

RAW DATA

The raw data, as obtained during the time-study, is presented in Table 1.

Table 1. Raw Time-study Data

Post-Automated Office		Pre-Automated Office	
Memo	Narrative	Memo	Narrative
5.47	22.50	6.30	38.70
4.83	21.20	6.50	30.00
5.33	38.33	5.90	35.30
4.88	24.13	4.00	32.81
5.92	28.42	4.30	39.25
4.92	24.83	7.90	38.33
		7.20	40.15
		5.50	31.17
		6.00	35.42
		5.30	39.20

To prove that statistical validity was ensured for all data collected, let's work out the above formula for statistical validity with a document-office type combination. Using the data for the memo-typewriter combination, the following data values were calculated/derived from the raw data.

$$N = 10$$

$$\sum X_i = 58.9$$

$$\sum X_i^2 = 359.82$$

The use of the formula results in N' being equal to 7.02 or equal to 8. Since N (which is 10) is higher than N', statistical validity was ensured and no more observation for this combination of document-office type was necessary. The same calculation was followed for all other document-office type combinations, thus ensuring statistical validity for all data collected.

DATA ANALYSIS

Productivity Calculation

The first step in data analysis consisted of calculating the average (mean) time for each document-office type combination. These average times (in minutes) are presented in Table 2.

Table 2. Average Times for Document-Office Type Combination

Post-automated Office		Pre-automated Office	
Memo	Narrative	Memo	Narrative
5.23	24.90	5.89	36.03

The second step involved the calculation of productivity. Productivity is calculated using the following formula.

Productivity = Average Time X Rating Factor X Allowance Factor

Rating is evaluating each operator's working speed against a "normal worker's" working speed. If the operator is observed to be slower than the normal worker, the rating factor is less than one. If the operator is observed faster than the normal worker, the rating factor is more than one. Rating is a judgemental process and in order for rating to be correct, the observer must be well-experienced. Another alternative is to assume a rating factor of one for all operators. Since the operators in this study were all experienced in their lines of work, the assumption of a rating factor of one was not considered unfair.

Allowance factor is provided for an operator's personal time, breaks, etc. If a 15% allowance is provided, the allowance factor is (100)/(100-15) = 1.176.

Using a rating factor of one and an allowanace factor of 1.176, productivities for all combinations of document-office type were calculated. These productivities are presented in Table 3.

Table 3. Productivity Data For Document-Office Type Combination

Post-automated Office		Pre-automated Office	
Memo	Narrative	Memo	Narrative
6.15	29.28	6.93	42.37

Productivity Comparison

A simple comparison of the productivity data revealed an improvement in productivity of 11.25% between pre-automated and post-automated offices for a memo; an improvement of 30.89% for a narrative. It is evident from the above data that improvement in productivity is higher when the length of the document is longer.

Statistical Testing of Average Times

At this point, it would be interesting to see if the average times obtained by this study were significantly different from a statistical point of view. First, let us look at the average times obtained for a memo. The appropriate data for the analysis are shown in Table 4.

Table 4. Testing of Average Times For Memo

Office Type	Number of Observations	Degrees of Freedom	Average Time	Sum of Squares
Post-Automated	6	6 - 1 = 5	5.23	1.1223
Pre-Automated	10	10 - 1 = 9	5.89	12.8690
		14		13.9913

By calculation, the variance of the differences between the two average times is

$$s_d^2 = 13.9913/14\ (1/10 + 1/6)$$
$$= 0.2665$$

Now, the two hypotheses could be formulated as follows.

H_o : The two average times for memo of post-automated and pre-automated offices are equal.

H_1 : The two average times for memo of post-automated and pre-automated offices are not equal

To test the above hypotheses, the t statistics was calculated as

$$t = (5.89 - 5.23) / 0.2665$$
$$= 2.4756$$

Using a risk level of 0.05 ($\alpha = 0.05$), the critical region was found as $t > t_{0.05,14} = 1.761$.

Since the calculated t was greater than 1.761, the null hypothesis (H_o) was rejected and the following conclusion was made.

There was significant difference in the average times for a memo of a post-automated office and a pre-automated office.

The same conclusion could be reached using a risk level of 0.025.

Now, let us consider for statistical testing the average times obtained for a narrative. The appropriate data are shown in Table 5.

Table 5. Testing of Average Times For Narrative

Office Type	Number of Observations	Degrees of Freedom	Average Time	Sum of Squares
Post-Automated	6	6 - 1 = 5	24.90	44.19
Pre-Automated	10	10 - 1 = 9	36.03	116.72
		14		160.91

Using the procedure followed for memo testing, the null hypothesis that the two average times for narratives of post-automated and pre-automated offices are equal could be rejected at a risk level of 0.005.

CONCLUSION

It has been estimated that productivity improvement of almost 100% is possible in a post-automated office environment over a pre-automated office environment. This estimate is based on the assumption that all typing works require revisions, corrections, etc. However, much of the work in an office requires "straight typing". In the case of "straight typing", productivity improvement is much less than 100%.

The present study revealed that improvement in productivity for "straight typing" is directly proportional to the length of the document to be typed. For a memo with 27 lines, the improvement in productivity was found to be 11.25%; the same data for a narrative with 71 lines was 30.89%. This represented an increase in productivity of 3.97% for each additional line of typing.

A note of caution should be mentioned. The average times obtained for post-automated office do not include the printing time. The rationale for not including this time was that the operator's work was acutally finished as soon as the typing was done. If the printing time were included, the improvement in productivity would be considerably less than what has been reported in this study.

REFERENCES

Barnes, Ralph M. Motion and Time Study - Design and Measurement of Work. New York: John Wiley and Sons, 1968.

Huntsberger, David V. Elements of Statistical Inference. Boston: Allyn and Bacon, 1967.

Kroeber, Donald W & Watson, Hugh J. Computer-Based Information Systems. New York: Macmillan, 1984.

OFFICE AUTOMATION AND THE "INFORMATION MANAGER"

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Increased quality and productivity will be expected as office automation technologies are applied to middle and upper level management. As these "work station technologies" are implemented a new information manager will be created. The application of these technologies will directly affect management style and the traditional managerial hierarchy. Further, the technology will require the development of additional skills and will demand extensive training programs in order for the technology to fulfill its potential.

INTRODUCTION

This paper has been developed to examine the projected impact of office automation technology upon the middle manager. The greatest strides in increased productivity to this point in the white collar environment have come as a result of changes in the office environment of the clerical and technical worker. Education has certainly shared in these productivity and quality enhancements.

Increases in quality and productivity are now expected at the next level of the organization--middle management. These improvements are expected to occur as a result of a greater use of the tools which improved clerical productivity, and as a result of the development of new techniques and strategies for "white collar" operations.

The implementation of these tools and strategies will have a major impact upon middle management. They will require reexamination of what it is a manager does and what skills are necessary for management. At their most basic level, the changes which result will require substantial training, retraining and adjustment on the part of those managers expected to use these new tools and skills.

At Lansing Community College the implementation of these tools has brought about increased efforts to plan for the changes which will occur. It is anticipated that the changes will affect work style, organizational structure and the nature of management responsibility.

What a Manager Does

One traditional definition of a manager is "an individual who combines human and material resources to achieve some stated purpose." A second equally traditional definition states that a manager is "one who uses information to make decisions and manage resources, such as people, materials, land, labor and capital."

Consistent with these two definitions, a number of traditional management functions have been identified. Although management authorities may vary in their presentation of these functions, there is a high degree of similarity from source to source. The five well known managerial functions are planning, organizing, staffing, controlling and communicating. In each of these managerial functions, the success of the manager is highly dependent upon a flow of accurate, relevant and timely information.

In an ideal environment it could be assumed that a manager carries out his or her responsibilities of planning or staffing or controlling in an organized uninterrupted way. However, in most day to day managerial environments such is not the case. In fact, studies to determine how managers spend their time have identified surprising results.

Rather than spending most of their time in highly productive work, most managers are barraged by a series of interruptions and diversions throughout the day. Many of these diversions and interruptions occur as the manager, or supervisor or subordinates attempt to identify or obtain information which is pertinent to the work at hand. Clarification of information issues, attempts to contact individuals for confirmation of details, fruitless file searches and other non-productive efforts occupy much of a manager's supposedly productive time.

Meetings, briefings and discussions are another major time commitment for most managers. These sessions are usually conducted for information gathering or information dissemination purposes and it is essential that the information provided be accurate and on-target. Irrelevant or incomplete information can cause delays or can lead to an incorrect decision. The productive use of managerial time depends upon the control of the manager's environment and upon access to accurate and timely information.

The Managerial Pyramid

Traditional views of the managerial hierarchy reflect the management structure as a pyramid, with three distinct managerial levels. On the first level, closest to the bottom is operational management. These individuals make up the largest group of managers, have essentially supervisory and technical responsibilities and are closely aligned with the production and quality of the product.

The second level of management is functional management. These managers oversee performance, monitor training, handle personnel and supervise the use of resources including equipment. Mid-level managers are often referred to as tactical management, since it is their responsibility to implement the management directions and policies which are handed down from upper management.

The third level of management, executive management, represents the peak of the pyramid. These managers are few in number and responsible for future planning, organizational direction and the overall strategy of the organization. This level is often referred to as the strategic level.

In this managerial pyramid, control and direction move from the top of the pyramid to the bottom. Information and information flow originates close to the operations at the bottom of the pyramid and is summarized and focused as it moves upward through the organization. Throughout the organization, management converts the information into action through the decision making process.

Changes in the Managerial Pyramid

One of the major impacts of office automation technology in the office has been the change which has occurred in the managerial pyramid. The initial emphasis of office automation has been to address those jobs where most workers are located--the jobs at the bottom one third of the managerial pyramid. Frequently, the most routine jobs and tasks are those which are most easily automated. As a result, electronic assistance in the form of automated computerized operational systems and large scale word and text processing have been implemented at this level.

The purpose of these systems is to eliminate repetitive tasks and increase the productivity of clerical, technical and operational management staff. This has been particularly true at LCC. Operational on-line computer systems such as payroll, general ledger accounting and student registration have been automated with great gains in efficiency and effectiveness. Large volumes of student related data transactions can be handled with ease, and the operational managers who are closest to the customers can deliver services more effectively.

As a result of this automation at the operational level, the organization has experienced cost avoidance or cost savings with equal or increased effectiveness. A second outcome is that the managerial pyramid is narrower at the bottom than it might have been without these changes.

This narrowing of the managerial pyramid has several direct results. First, it diminishes the number of supervisory or operational line managers required by an organization. As clerical task are automated, the number of clerical personnel either remains steady or decreases, which brings about a decrease in the number of operational managers required for supervision purposes. The large numbers of clerical responsibilities which required managerial supervision are now to a great extent automated or delivered with the assistance of computerized systems. In addition to decreasing staff the automation process also often analyzes and reduces complex functions into less complicated subroutines which can be more easily managed. As a consequence, what may have once been a mid management responsibility is often assigned, in the form of component parts, at a lower level in the organization.

The Information Manager

As stated above the purpose of the most current operational on-line computerized system is to eliminate repetitive tasks and increase the productivity of clerical staff and operational managers. If new systems can be designed which increase the productivity of mid and upper level management by the same amount as clerical productivity has been increased, the net effect on the corporation will be a dramatic increase in corporate productivity.

Type of Employee	Annual Salary	Productivity Increase	Net Gain
Clerical	$12,000	10%	$1,200
Managerial	$30,000	10%	$3,000

In order to increase the productivity of mid and upper level management, an interesting capitalization change is beginning to occur. When the American work force is classified into four economic sectors, Agricultural workers, Industrial workers, Service personnel, and Information workers, the capital investment per worker in the United States, broken out by these sectors is as follows:

Sector	Current Capitalization Per Worker
Agricultural	$55,000-$85,000
Industrial	$25,000-$35,000
Service	$5,500-$6,500
Information	$2,000-$2,500

It is quite clear that there is very little capital investment for each worker in the information sector. This lack of capital investment becomes quite obvious if the current tools of a manager in the information sector are examined. The manager has at his/her disposal:

A Desk
Chairs
Office Supplies
A Telephone
File Cabinets
A Calculator

However, the projected capital investment per worker through 1990 emphasizes that major changes will be taking place. The main reason for these changes are the efforts to increase the productivity of mid and upper level management.

Section	Current Capitalization Per Worker	1990 Projected Capitalization Per Worker	Percent Change
Agricultural	55,000-85,000	55,000-85,000	0%
Industrial	25,000-35,000	35,000-45,000	28%-40%
Service	5,500-6,500	7,500-8,500	30%-36%
Information	2,000-2,500	8,000-8,500	340%-400%

This projected change represents a 400% increase in the level of capitalization per worker in the information sector. When this increased capitalization per worker is compounded by the fact that the number of information sector workers is constantly increasing, the projected expenditure in capital investment, for information workers, is a total of 300-400 billion dollars by 1990.

The net effects of this major change in capital investment will mean new tools and new roles for managers in the information sector.

New Managerial Tools

The first change that a manager will see is that increased capital investment will provide new and different tools. In the future manager's tools will include:

A Desk (as in the past)
Chair (as in the past)
Office Supplies (as in the past)
An Audio Communications Systems
A Video Display (either a dumb terminal or a personal computer)
A Keyboard

These tools are embodied in work station technology which is designed to enhance and expand the manager's capability to carry out managerial functions.

As a result of the video display and keyboard, the manager will have word or text processing readily available. Rough drafts of documents may be entered directly by the manager. Or final drafts, that may have been entered on the word processing system by the secretary, can now be recalled, proofread, and corrected by the manager using his/her video display.

The video display will afford the manager electronic spread sheet capabilities, either through a mainframe or through a microcomputer. Over one hundred PC electronic spread sheet packages are currently available. These allow users to easily build relationships between various data elements and explore the net effect, on other data elements, by changing one data element. Financial management and planning which involves "what if" questions is greatly enhanced.

In addition to spreadsheet projection and analysis, graphics capabilities will also be readily available to the manager. This capability will allow information to be displayed in pictorial format so that trends or exceptions may be more easily recognized.

The most significant change brought about by the easy access to a video display will be in the area of communications. Incoming mail will be electronic, that is messages and letters will be sent and received through the video display. Each manager will have an electronic "in basket" similar to the traditional "in basket" on the manager's desk. The user may discard, forward or file each piece of electronic mail. If the letter is filed, a number of cross references may be built (sender, subject, date) in order to aid in finding the document later. The video display can also be used to create reminder or "to do" files. The display will also notify the user of upcoming events, or remind him/her when it is time to attend a meeting. With the manager's calendar on the video display, secretaries and others will be able to more easily schedule meetings and conferences.

The new information manager will continue to have a telephone, but its use will differ. Due to the availability of the video display and the ease of sending electronic notes, much less time will be spent playing "telephone tag". If the manager does not wish to use the electronic mail facility, the telephone may be connected to an electronic audio distribution center. This will allow managers to record verbal messages that can later be recalled. The principle is similar to a telephone answering machine except that the caller makes the determination if he/she wishes to leave a message.

All of the above applications are benefits derived from the manager having immediate access to a video display and the appropriate software. However, if the video display can be linked to the corporate computer, the real benefit will be the amount of information that will be literally at the manager's finger tips. Linkage to organizational data bases gives the manager the ability to quickly and easily display detail and summary information, or to retrieve documents that were previously filed. As a consequence there will be less time spent gathering information and more time using the information. That is, the manager will have more time to be managerially productive - analyzing information, planning and making decisions.

At the present time, all of the applications discussed above are available and in operation at hundreds of organizations around the country. In contrast to the past when clerical workers faced adjustment problems, it is now managers in every sector who are faced with the adjustments and impacts which result from these innovations. It is clear that the capital investment which will create the new information based manager is now underway.

Adjustments

Today's manager is required to make some rigorous adjustments in order to maximize the effectiveness of these new tools. People who are technophobics, that is people who fear technology, may not be able to survive as new or information based managers. They may have to find employment in more traditional offices.

Skill adjustments will be necessary in the areas of keyboard skills and in written communication skills. Good keyboard skills will become very advantageous and almost a necessity for a manager. This may require a drastic re-examination of roles for those managers who feel they should be managing, not keyboarding. However, access to information and the ability for streamlined communication will be at the manager's fingertips. In truth, the better the manager's keyboard skills the more time the manager will have in which to be productive.

Making the adjustment from information on paper, to information on a video display will be quite traumatic for some managers. The new manager will not have a "paperless" office but will have less paper in the office. Sending messages electronically, which were formerly sent verbally will require better communication skills. Since the person receiving the message will not be able to instantly ask for clarification, the message must be clear and concise. The absence of personal face to face interaction eliminates many subtle and often highly visible communication channels. Also, if the message is sent electronically, the receiver cannot ignore the message because the system will confirm to the sender when the message is displayed by the receiver.

A major adjustment which many managers will face will be directly related to what may appear to be a diminishing importance given to the human resources elements of their job. As information becomes more readily available it is possible that the extent of interpersonal relationships will diminish. The manager who may have cultivated "sources" of information or who may have relied on their ability to read gut impressions may find the information much more easily obtained, by a much larger number of people. The recognition of how these excellent interpersonal skills can be maintained as an asset to the organization will be a critical adjustment on the part of the manager and the organization.

Some or all of the above adjustments will be necessary on the part of today's manager in order for him/her to meet the requirements which will be associated with the new information manager.

Training for the New Information Manager

It is clear that major gains in productivity and effectiveness will occur as a consequence of increased attention and increased investment in middle and upper management. However, if these major gains are to take place, effective training in the use of the new office technologies must also occur.

It is estimated that with any new technological innovation implemented in an office, only ten percent of the total cost is for hardware. The cost of the associated software and support systems makes up another forty percent of the total cost. The remaining fifty percent of the total cost is for training the users of the equipment and the software. As work forces shrink and larger and larger amounts of new technology equipment is applied to managerial operations, the effectiveness of the training provided becomes extremely important.

The major impact of insufficient training is that the technology fails to fulfill its initial promise. In fact, the technology may often result in decreased productivity for a long period of time as personnel gradually learn how to use the equipment.

At LCC many of the systems which make up the College's overall management information system have been designed with the direct involvement and assistance of operational staff in an information systems development process. One result of this process has been that the users of the system have been very aware of the impacts and consequences of the system upon their operation. Usually, the result for the users is streamlined operations, greater productivity and increased quality of operations.

As the systems implemented become less clerical, with a greater emphasis on the management information required for tactical and strategic decision making, the uses of the system and the information it produces becomes more subtle. For example, a go or no go decision on a section of a particular course, or a decision on the award of financial aid is often quite clearly prescribed by the parameters of the system. The clarity of these operational managment decisions diminishes as decision making moves up the managerial pyramid. A decision by a dean or departmental chair to reallocate space usage within a department can require much more information and can have a direct impact on a greater number of people. The information necessary to make this decision is available; what is not often available is the prescribed framework within which the information must be considered. As in the past, the manager is expected to make this decision. The difference today is that the information is readily available.

The development and use of the tools now available for the new information manager require that an organization address three major issues in training its managers in the use of these tools. The first issue is the use and function of these new tools. As we discussed above, keyboarding may be required and written communication skills for the use of electronic mail and messages may need to be polished. A second and much more complicated issue is how information is to be used most effectively in the decision making process.

A third major issue must be addressed as extensive new equipment is implemented and the training programs necessary to create new information managers occur. The organization must recognize that the ultimate key to productivity and high quality is through the commitment of its employees. The development of the human resources within each office involved is critical. In the past several years an innundation of books, articles, and consultants has emphasized the key strategies in Japanese management style. The growing emphasis on consensus, involvement and commitment to organizational goals can be strengthened through the training provided in the implementation of these new technologies. The technology is not intended to replace the manager. Rather, it is intended to enhance and amplify the manager's ability to develop a greater understanding and to make better decisions.

LCC has begun to address these issues in a series of steps designed to provide training for its staff in the use of the tools for the new information manager. The College has established and staffed an Information Center. This office is responsible for PC hardware and software selection and for the initial training of PC users. The implementation of PROFS, Professional Office System has been carefully planned and scheduled by the College's Information Systems and Computer Services Department. The training needs of word processing users are now supported by the services of a word processing trainer who is also on staff in the ISCS Department. Further in depth word processing training is scheduled for users of new word processing systems scheduled for implementation early in 1985.

The training needs of staff working with the new technology have also brought about changes in how operational systems are implemented. Whenever a new operational system is now implemented, formal training sessions open to all potential system users are scheduled at a number of times prior to implementation. In addition, the key individuals to contact for further assistance are identified in these sessions, and informal users groups are established.

Training for the College's managers in the use of the PC and PC decision support software, particulary Lotus 1-2-3, has been provided by the College's Professional Development Office. This training was provided in depth for twenty college administrators over a six week period. Additional one and two day seminars have been offered which examine the impacts of the new information technology on managers and the management function at the College. The message which has been consistently delivered is that the tools are not productive without the training.

Most significantly, it is recognized that the new management tools have changed and will continue to change the style, structure and results achieved by the College. Although the College has suffered severe budget reductions and staff cutbacks which total approximately eighty full time positions, quality and level of services have been maintained. One major reason that this has been possible has been the effectiveness of new information technology.

Conclusion

It is clear that the major changes which have occurred in the field of office automation have led to increased productivity in clerical and technical jobs. It is also clear that these expectations for increased productivity are being extended to the ranks of middle management. To deal with these changes it is necessary for colleges and universities to conduct good planning in the selection of hardware and software and then carefully plan for the implementation of these tools. However, it is critical that the planning which is conducted to implement these technological innovations also take into consideration the most crucial element--the training of middle management in the use of this technology. Without this training the innovations will fail to reach the levels of increased productivity which are expected.

IMPACT OF INFORMATION MANAGEMENT IN THE UNIVERSITY SETTING: A CASE STUDY

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Increasing information needs and proliferating information technologies have set the stage for a transformation from data processing to information processing. Although the needs and techniques are established, a successful transformation requires new managerial approaches to coordinate and control the full spectrum of information resources. Many organizations are responding by establishing the role of Chief Information Officer, charged with directing the evolution and integration of information processing throughout the organization.

This paper traces the impact on a University which added a Chief Information Officer and reorganized campus information services. Organizational, political, and social factors are analyzed, as is the impact on attaining University goals. Implications for other institutions considering similar organizational changes are also discussed.

Introduction

Constantly changing information technologies and methodologies provide both challenge and opportunity. The microcomputer invasion, rapid growth in end-user computing via mainframe and microcomputers, networking, the availability of fourth-generation development tools, distributed data entry, the rapid spread of office automation technology (word processing, electronic mail, filing, calendar, etc.) - these are some of the developments contributing to the complexity of information management and to the need for formal coordination of this function.

Although there are different perceptions of the appropriate role for the information management function, the concept is based upon several widely accepted assumptions:[1]

- information is a valuable resource;
- information is not consumed by use, thus it can be reused for other purposes [illegible] beyond its original purpose;
- information can and should be managed;
- if it is to be managed, information must be collectable and not isolated within the institution;
- information products and services are expensive and their cost must be justified on the basis that they will be used;
- "management of information implies that opportunities exist to conserve information, to provide effective utilization of information, and to promote the efficient use of the resources needed to provide information.

Information management is a way of organizing information and information techology to meet institutional needs by maximizing use, minimizing cost and assigning accountability. In higher education this challenge is exacerbated by the increasing complexity of the environment in which institutions must operate. Colleges and universities need more information for strategic decision making, and responses to this need must be faster and more accurate than ever before. The demand for information and computing in all forms and the cost of keeping up with the need is creating a revolution on our campuses. Increasing numbers of institutions are finding that they need a senior-level administrator to keep abreast of the changes in the technology and to manage the integration of information processing throughout the organization.[2]

The function of information management is to coordinate the total information processing and handling environment to promote effective and efficient utilization of information resources and products. The technologies and services typically coordinated include data processing, communication networks, microcomputing, information center services and office automation technologies.

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[1] Forest W. Horton, Jr., Information Resources Management (Cleveland: Association for Systems Management, 1979) Chapter 2.

[2] Judith A. Turner, "As Use of Computers Sweeps Campuses, Colleges Vie for 'Czars' To Manage Them," Chronicle of Higher Education, May 30, 1984, p. 1.

This paper addressess the impact on Northern Kentucky University resulting from the addition of a chief information officer and reorganization of the major information services under that officer.

The Campus Environment

Founded in 1968, Northern Kentucky University is a state assisted institution serving a primarily-commuter population of nearly 10,000 students. Situated on a dual campus of [illegible] acres this institution serves students from the northern Kentucky region and the greater Cincinnati metropolitan area. Despite its relative youth, the University is managed by a well developed bureauacracy. However, organizational change is more frequently attempted and more readily accomplished than is often the case with older institutions. Politically the campus is divided into the usual academic-nonacademic camps with frequent tension between the two. Stress is increasing as enrollment stabilizes and resources become scarcer.

Computer Services and most other major support units report to a non-academic area of the institution, thus setting the stage for academic concerns about the level of support received. Until four years ago Computer Services operated without an advisory or policy group to provide an institution-wide perspective to guide the work of the center. It is to the credit of the Director and the Vice President to whom he reported that services and systems development efforts were equitably distributed. Recognition of the need for a more structured method of establishing priorities for this high-demand, high cost service eventually led to establishing a Computer Services Policy Committee. Membership was composed of the university's chief line officers and the Budget Director, thus insuring both an institutional perspective and high-level support for major decisions.

Superficially, one might question the effectiveness of the Policy Committee, for in the four years of its existence, no new application systems have been developed, while in the period preceding the Committee's involvement, new systems were developed at a rate of one or more per year! However, closer examination shows that the Committee indeed dealt with substantive issues and made significant progress.

The Committee first addressed the need for a long range plan which would provide a statement of direction and identify general priorities for information systems. The services of an outside consultant were obtained to assist the university in clarifying and developing its statement of needs. An Office Automation/Information Processing Task Force was created and charged with defining office automation needs and recommending courses of action. The Policy Committee also reviewed and endorsed the plan of the Vice

President for Administration to reorganize most university information resource units under a chief information officer. During the past year, the Committee, now renamed the Information Management Policy Committee, has reviewed and endorsed the major activities and policies initiated since the reorganization.

The Reorganization

During the Fall of 1982 the Vice President of Administration recommended to the Policy Committee and to the President that the information resource functions of computer services, word processing/office automation, and institutional research be grouped under the umbrella of information management and that a new position of Assistant Vice President for Information Management be created to head the unit. Approval was given and the position filled in October 1983. Although the Information Management unit is responsible for networking, the voice and video systems still remain the bailiwick of the business services officer. Because both areas report to the same vice president, coordination of planning for future voice and video processing with those for data and text processing will be feasible.

After the organizational restructuring, the Policy Committee was renamed the Information Management Policy Committee and the scope of policy decisions broadened accordingly.

Organizational, Social and Political Factors

From an institutional perspective, significant benefit should accrue from combining information resources under one organizational umbrella. However, what conceptually appears logical and appropriate can be difficult to achieve because of the human factors involved. Change is disruptive to the established order and potentially threatening to the personnel involved.

As Machiavelli noted in 1513,

> "There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success than to take the lead in introducing a new order of things...an innovator has as enemies all the people who were doing well under the old order, and only half-hearted defenders in those who hope to profit from the new."[3]

At Northern Kentucky University, these human problems were compounded by varying levels of maturity and status of the individual areas involved in reorganization. To illustrate:

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[3] Niccolo Machianelli, The Prince, translated by Robert M. Adams (New York: W. W. Norton & Company, 1977) p.17.

- Computer Services was, and remains, a strong, well established and well-respected operating unit of the University, responsible for support of both academic and administrative computing.
- Institutional Research on the other hand, was a fledgling organization which had been staffed with a half-time director and one support staff position. At the time of the reorganization, the director's position was vacant.
- Word Processing/Office Automation was little more than a vision held by the task force assigned to conduct a needs analysis and provide a final report.
- Microcomputing was nonexistent as an organizational function. Micro purchases were frozen by institutional mandate pending completion of the reorganization and development of operating policies and guidelines for micro acquisitions.

To unify these dispersed entities into a cohesive unit was no small task. The Computer Services group was clearly at greatest risk from the reorganization, having been the major information provider for many years. Microcomputers have typically been perceived by computer centers as a threat to their institutional prestige and importance, and arouse concerns about data security and integrity and general loss of control. Further, the development of strong Institutional Research and Office Automation units could represent two additional extremely demanding users for computer services and resources.

Despite these potential friction points, major problems were averted, the reorganization proceeded smoothly and the new Information Management unit achieved significant accomplishments during the first year of operation.

Much credit must go to the leadership provided by unit heads in each functional area. The Director of Computer Services is extremely service oriented and he willingly involved his staff in active participation in the broadened information management functions. The new Institution Research Director and Word Processing unit head are both enthusiastic advocates for their respective areas, while recognizing and supporting the interrelatedness of the Information Management organization. (Microcomputing and an associated staff computer literacy program have been coordinated directly by the Information Management Office for this first year.) Unified by the shared mission of providing support services to meet institutional information needs, cooperative relationships quickly developed.

Impact

Progress: The chief information officer has just completed the first year at Northern. During that period, the reorganization and integration of existing departments and initiation of new functional units has been accomplished. The information management operation as a whole is functioning smoothly. Progress has been made in focusing information services in support of the institutional goals of implementing strategic planning and decision support functions within the institution, attaining faculty/staff computer literacy and promoting efficient institutional operations:

- A full-time Institutional Research Director is on board and making significant contributions to the information resources needed by the University for strategic planning.
- The Office Automation Task Force recommendations led to development of an action plan and implementation is well underway.
- A coordinator has been assigned to implement a dedicated word processing project, establish policies, administer the system and provide in-house instruction and consultation for users.
- The micro freeze is over, acquisition policies and procedures are in place. A major institutional purchase of microcomputers expanded available word processing capabilities and supports other office automation efforts.
- Additional micro hardware, staffing and space resources have been assigned to the faculty/staff computer literacy effort.
- An action plan has been developed for microcomputer based user-computing support and the administrator/support staff portion of the computer literacy effort. Implementation of first-year activities is being coordinated through the Assistant Vice President's Office with staffing supplied by a cadre of part-time personnel.
- An institutional commitment has been made to base all new systems development on data base technology needed to provide a solid foundation capable of supporting decision support needs. Specific applications software decisions are expected momentarily.
- Evaluation of numerous mainframe user-computing tools led to a recommendation to purchase specific packages which can support 1) user computing on the mainframe and 2) access to mainframe data for download.

Reorganization: For several years pressure had been mounting to create a separate academic computer center. The additional resources which would be required to maintain two centers precluded such action. However, after the infomation management organization was in place, separation efforts were renewed, spurred on by Academic Affairs' perception that the computer service function had been "demoted" in importance and moved one step lower on the organizational ladder.

Considerable soul-searching and evaluation of alternatives took place before the institutional decision was made to add a postion of Director of Academic Computing, reporting to the Provost's office. This officer is the director and coordinator for the faculty component of the institutional computer literacy effort. The Director's role also includes promoting all areas of academic computing, monitoring resource needs and assisting the academic sector in establishing priorities for utilization of available computer resources.

The Academic Computer Director's position is too new (five months) to predict the ultimate impact. The initial period has been marked by considerable friction between two computer "Directors" where only one has direct responsibility for management of resources. Difficulties have resulted from the need for an operational definition which distinguishes between monitoring and managing. Despite these initial difficulties, the Academic Director's position is seen as having a positive impact on the institution. Definition and direction of a faculty computer literacy program must of necessity come from the academic sector of the university. The instructional support services needed to mount such an effort far exceed the user services resources available through the information management unit of the institution. And finally, there is need from someone to serve as a catalyst and focal point for faculty computer needs.

Alternate Structures for Information Management

Although the information management concept covers all information technologies and information handling disciplines, most organizations do not initially throw them all into the same organizational melting pot. Many organizations use an evolutionary approach to reorganization, with initial emphasis on the highly visible areas of computing, computer communications and office automation technologies. In contrast, some organizations have in one step designated a single officer to be responsible for all functions involved in the collection, use or dissemination of information. Most specialists in the area of information management recommend the evolutionary approach.[4] They conclude that each organization should examine its own operation to determine the appropriate information management jurisdiction based on an assessment of how the information resource can best support institutional goals.

The placement of information management within the organizational structure also varies. At Northern Kentucky University the chief information officer (CIO) reports to a vice president. Most institutions with this postion place it either at this level or reporting directly to the president. Where the information resources to be coordinated fall within the jurisdiction of a single vice president, the new position will usually report to the vice president. In cases where responsibilities touch on areas that formerly reported to more than one vice president, the new position will typically need to report to the president. It has been suggested that the developmental level of information processing at an institution should also be a determining factor for organizational placement. A separate line entity is appropriate for organizations with mature computer systems and experience managing information.[5]

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[4] Forest W. Horton, Jr., "The Invisible Revolution," Computerworld, In Depth, August 16, 1982, pp. 3-5. Also see Gerald L. Matlin, "IRM: How Will Top Management React?" Infosystems, October 1980, p.46.

Just as there is no single definition of the information management jurisdiction which can be appropriate for all organizations, there is no "best" placement for the function within organizations. A significant factor to be considered regarding organizational placement is that - for the foreseeable future - demand for information products and services of all types is likely to far exceed available resources. This is prone to create a situation where all users will feel their needs are less than optimally addressed. Heading the information management function with a vice presidential level officer certainly helps remove any suspicion of bias concerning recommendations, policies or services provided. However, placing the high-cost complex function on a separate line makes it politically more vulnerable particularly if the computer sophistication and technical understanding of institutional leaders is low.

Implications and Conclusions

After one year in operation at Northern Kentucky University, the information management unit appears to be making a significant difference. A number of needs which had been placed on 'hold' are now being addressed, stalled projects have been reactivated and planning for the future is an on-going process.

The excitment and challenge associated with organizational change has served in this example to motivate the personnel involved. Initial steps have now set the stage for meeting institutional long-term information needs. However, much remains to be done to turn potential into reality. The initial momentum for accomplishment must not be lost as the information management unit matures. Toward that end lies the managerial imperative.

In the broader context of higher education, information management is a concept whose time is coming for growing numbers of institutions. Ultimately it will be a mandate that all colleges and universities take seriously Keller's "technological imperative",recognizing and utilizing the impact of evolving information technologies.[6] As institutions of higher learning, colleges and universities must not only meet the challenge of training people to work in the information society, but must also successfully incorporate these technologies in our own management. The pervasive role of computers and other information technologies is one that will only increase with time.

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[5] Eileen Trauth, "Research-Oriented Perspective on Information Management," Journal of Systems Management, July 1984, p. 17.

[6] George Keller, Academic Strategy. (Baltimore: Johns Hopkins Univeristy Press, 1983) pp.19-22, also pp. 121-139.

LIST OF REFERENCES

Binberg, Herbert. "Effective Management of Information: How to Meet the Needs of All Users," Management Review, February, 1984, pp. 8-13.

Carey, Lynn. "Integrated Management Precedes Integrated Communications," Infosystems, July, 1984, pp. 106-108.

Holmes, Fenwick W. "IRM: Organizing for the Office of the Future," Journal of Systems Management, January, 1979, pp 24-31.

Horton, Forest W. Information Resources Management. Cleveland, OH: Association for Systems Management, 1979.

Horton, H.F., Jr. "The Invisible Revolution," Computerworld Indepth, August 16, 1982, pp. 1-5.

Keller, George. Academic Strategy. Baltimore, MD: Johns Hopkins University Press, 1983.

Machiavelli, Niccolo, The Prince, translated by Robert M. Adams. New York: W. W. Norton & Company, 1977.

Matlin, Gerald L. "IRM: How Will Top Administrators React?" Infosystems, October, 1980, pp. 40-48.

McCredie, J. W., ed. Campus Computing Strategies. Bedford, MA: Digital Press, 1983.

Nesbitt, John. Megatrends. New York: Warner Books, 1982.

Trauth, Eileen. "Research-Oriented Perspective On Information Management," Journal of Systems Management, July, 1984, pp. 12-17.

Turner, Judith A. "As Use of Computers Sweeps Campuses, Colleges Vie for 'Czars' To Manage Them," Chronicle of Higher Education, May 30, 1984, p. 1.

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Track V
Microcomputer Issues and Applications

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THE BEST OF BOTH WORLDS:
AN APPLICATION USING MICROS AND MAINFRAME

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ABSTRACT

This paper describes adapting a centralized budget system to employ microcomputers as well as a mainframe and to distribute data to departmental users for their micros.
The system spreads annual budget among fiscal months to monitor monthly performance for more than 1000 funds with 500 budget categories. Interfaces with other financial programs were preserved. Data is entered and edited on a micro using the Lotus 1-2-3 spreadsheet and then transferred to mainframe programs for spreading and printing. Data is grouped by recipient for diskette production and distribution. A user's data can also be stored on the mainframe for later retrieval, thus bypassing diskette production. Distribution is being expanded to include personnel budget worksheets, monthly analytical reports, and input from user diskettes to the mainframe system.
Many departments contributed to development. Programming staff developed mainframe spread programs and file transfers. Budget staff developed micro routines, using Lotus 1-2-3 macro commmands to replace custom programming and reduce staff training. Others contributed translation software and formal spreadsheet instruction.

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A little over a year ago at Duke University, we in the central budget office were faced with rewriting our key computer system. Into that system we input the budgets for well over 1000 funds, detailed in over 500 categories of expense and revenue. These annual budgets are used in the University's standard accounting reports, such as the monthly general ledger. We also break up the annual budgets, line by line, into monthly budgets, and use them in a number of analytical reports which compare actual and budgeted dollars. Analytical breakdowns are quite flexible, including a detailed analysis for every code; a summary in the format we use to report to our Board; and reports custom-built for 75 persons with a variety of departmental and budget category summaries.

Some years ago, a financial-analyst-turned-programmer developed the office's original computer systems on a remote mainframe called TUCC. Gradually, the Duke Business and Finance Data Processing programming group (BFDP) developed new systems on the Duke mainframe (DUCC), and we moved some old programs from TUCC to DUCC. Still at TUCC, however, was the input and spread system, the most complex of all.

A year ago, the only support for programs still at TUCC was a contract with the original programmer, who had left Duke and operated from rural Tennessee over the telephone. Our office used different terminals for each mainframe but had no micros. The interface among our various systems was poor, and documentation was not up-to-date. The budget system had no flexibility to accommodate our special needs, such as generating reports for budgetary hearings, and departmental requests for special data were time-consuming, expensive, or impossible to meet.

Instead of writing a new mainframe system, we chose to use a standard spreadsheet (Lotus 1-2-3) for entering and editing data on a micro and then to transfer the data to the DUCC mainframe for spreading and printing. We also chose to try something new: to group data and distribute it on diskette to departmental users.

Those choices were determined by several goals:

INCREASED SECURITY, CONTROL, & BACKUP - We wanted our programming support on campus, with more than one programmer knowledgeable. We wanted better security for our data. We wanted better documentation, for the programs themselves and for the office staff's procedures. We wanted a system that could be learned easily in the event of turnover in the office.

INCREASED EFFICIENCY - We wanted to better integrate all our systems that use the budget files. We wanted to reduce on-line time if possible, to free funds for needs we had been unable to meet. We wanted to standardize equipment and reduce the keyboards, protocol, and expediting which the staff had to understand.

INCREASED FLEXIBILITY - We wanted to get data for special presentations and to meet non-recurring data needs without resorting to new mainframe routines. We wanted to get personal computers into our office. We wanted to begin meeting the needs of departmental users for micro-compatible data.

We were not in the best position for reaching these goals. Because we had to preserve interfaces with existing accounting and analytical reports, the programming had to be done by BDFP, who had no micro experience. Even worse, the budget office staff had little micro experience and no micro equipment.

Fortunately, we had a strong working relationship with our programmers, and we were not starting from scratch with anything except micros. We had a clear idea of our existing system's strengths and weaknesses. And we had an office staff that was used to working with computers. Although we could expect office turmoil during the conversion, staff preferred DUCC to TUCC and wanted to change. They were attracted by the notion of eventually having only one keyboard to use and by the possiblity of placing one micro at each desk, eliminating constant migration about the office. They were a control-oriented group, used to balancing and checking, and they had dealt with testing routines before. Finally, I believed that once acquainted with the micro, they would be won over by its potential for analytical work and by their increased ability to understand and control their work in the micro environment.

HOW THE NEW SYSTEM WORKS

We use two IBM XT's with 512K. Each is equipped with an IRMA board for 3278 emulation and PC Com for file transfers. The mainframe batch jobs are written in structured COBOL and run on the DUCC IBM 370/3083. Preliminary sorting and organizing of data is through Syncsort utilities. We have two IBM PC's also available for spreadsheet work and 3278 emulation through connections to a dedicated IBM 5520 word processor without file transfers. We use a wide carriage Epson FX-100 printer and have on order an IBM 5218 letter-quality printer.

Although I did outline our total equipment needs at the start of the project, I was not too specific. I outlined a system that would probably utilize one micro per staff member but said we should add units only as we needed them. This way I was never faced with having to go in and ask for equipment I had never suggested we'd need without locking myself in to specific configurations before I understood them. By delaying the purchases, I thought we might take advantage of technological advantages, and we could finance the system more easily. Purchases were offset by some savings though cancellation of leased equipment.

Traditionally we run a batch job to produce budget workpapers which show prior year actuals, current year budget, and 6 months current year actuals, with line items for each fund. The BFDP project manager suggested that we begin the new system with a copy of these workpapers, to eliminate our keying anything other than approved dollar amounts.

Therefore, we first run mainframe jobs to produce the budget workpapers and to create a copy formatted for transmission to a micro. We choose one of two sorting routines. For our office, budgets are grouped in the same standard 34 batches used in the old system and defined by the categories we report to our Board of Trustees. For departmental users, budgets are grouped by administrative responsibility. (This grouping makes use of an already-existing sorting routine used to print workpapers in administrator order rather than in code order.) We distribute printed copies of the budget workpapers to all departments and diskette copy to some departments. (I will describe the distribution system in some detail later).

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In the budget office, we download the workpaper batches and use them for any special presentations. Meanwhile, departments prepare budgets manually or using micros. Each department completes its budget and obtains the approval of the senior officer to whom it reports. The approved budget is then given to the budget office, where it is checked for adherence to wage policy and for arithmetical errors. Then cost distributions for general and administrative expenses are applied, intradepartmental allocations are made, and adjustments are calculated for those codes with fixed agreements for bottom lines. The completed budgets for all codes are then incorporated for presentation to the Board in May.

Budgets can then be input for mainframe accounting and analytical reports. For each batch, the downloaded workpaper files are imported into a Lotus 1-2-3 template. Only the dollar amounts for line items in each budget need be keyed. Prior year actuals and current year budget are deleted. Data entry is facilitated by macro commands, which produce totals for each fund, produce a total for the entire batch, delete zero lines, save, and insert new lines with automatic formatting. A loading macro allows the staff to use the keypad without having to shift between numbers and cursor directors.

When data entry has been completed and balanced, the data is reformatted and a print file created, again with a macro to reduce error. The print file is uploaded to the mainframe.

We next create a preliminary calendarization of the annual budget by spreading it into 12 individual monthly budgets. In prior years, we printed out the annual budget, sent it to departments for their ideas of how to spread it, added our own notions, and then input spread codes or manual amounts. The old method resulted in a delay; often budgets were returned to us late, and analytical reports even in September showed no spread. Furthermore, the spread by code routine was used only on the first spread. Changes later in the year had to be calculated manually and the new numbers exchanged with the old in a laborious edit procedure.

The new system makes a preliminary automatic spread, based upon assumptions about each category of expense or revenue. For instance, biweekly payroll is spread by the number of pay periods in each fiscal period, but monthly payroll is spread 1/12th. We distribute copies of the automatic spreads to departments. A department with no special timing problems does nothing since its budget spread is complete. A department with no idea about how to spread its budget need not try. A department with some special timing problems need enter only a few spread codes. And a department whose entire budget must be respread manually will spend no more time under the new system than under the old.

The spread program computes fund totals, checks three files to select the descriptive headings, and prints out a report. It also puts out a new micro file, which can be downloaded and used to alter the inital spread.

To alter the spread, we download the new print file and import it into a Lotus 1-2-3 template. Initially we had planned to do some of the respreading on the PC, using macros. This turned out to be impractical because of the vast amount of memory used up by essentially placing a formula in each monthly field for each line item. Instead, we need key only the new spread code (for line items to be respread by the computer using the spread code) or enter the manual spreads which do not fit the code system. One macro is used to load spread codes. Another for manual entries even checks that the annual budget equals the sum of the 12 months as keyed in. Once the changes have been made (including changes to funds, objects, components, amounts, or spreads) and the batch balanced, the file is reformatted, uploaded, and the same spread program run again. Both a new hard copy and a new PC file are generated. This same process can be repeated throughout the year whenever adjustments are needed to the budget.

HOW WE DID IT

Two decisions set the direction for the entire project: to perform all data entry and edit on the micro, and to distribute data to departments to use on micros. So the first step was to learn the micro's capabilities.

Both BFDP and the budget staff invested time and money in this exploration. Inital review suggested we would need to handle fairly large files. We purchased XT's and attended on-campus micro classes. The budget staff concentrated upon learning to use spreadsheets. BFDP concentrated upon equipment and the file transfer problems, testing files to assure that all data were transmitted and received accurately.

I also talked with other departments about their micro applications and needs for budget data. I discussed our system repeatedly thorughout its development with the Computer Center (both mainframe and micro services groups), with the accounting department, and with other university budget offices. I also talked with other University programming groups about micro applications they had done.

I have said that neither we nor BFDP had any micro expertise before beginning this project. One of the real strengths in the Duke arrangement for computing, I think, is the existence of several programming groups who operate somewhat independently of one another. Thus users are not restricted to a "party line" when contemplating an application, and the programming/operating staff can call upon one another's specialities. So when we and BFDP bought equipment or software, we could call upon other Duke groups for advice. User Services helped with purchase orders,as did a central purchasing agent who specializes in computers. We could buy a 3278 emulation board and a file transfer program that had been tested at Duke. User Services had micro courses available in labs so that even those without equipment could learn. There was a consulting group available who would even discuss software problems and a service that the novice micro owner could call for repairs and installations.

I had to identify and seek out this help myself, but the effort paid off in unexpected ways. I was able to anticipate problems I'd not have known about. I found people to call for spreadsheet tips. I had the opportunity to influence the standardization of the Duke spreadsheet. I saved considerable time when User Services recognized administrators' needs and took special pains to include them in the first Lotus 1-2-3 class. I could consider departmental users developing the distribution and spread system. I was able to pass on spreadsheet tips to some departmental people from whom I need help, too, and thus improved my working relationship with the primary group I support. The Computer Center director shared a program which could convert my print files into Multiplan, enabling me to offer unexpected support to some departments.

While I had to develop new relationships with micro people, I could count on a well-established working relationship with BFDP. I usually meet with the programmer and the manager over a formal agenda only at the beginning and toward the end of a project. We hold several short meetings involving the project manager, at critical points when BFDP wants to present a particular problem or choice. Most communication on a particular project is simple: the programmer and I call each other. During a major project, I don't throw out a flurry of memos, although I often send notes for small requests on other matters. We constantly check with each other about deadlines and calendars so that we know where we stand. We both try to remain flexible about deadlines and declare "can't miss" dates early. I try to provide as much as possible for them, using an existing report or a print chart to demonstate output. For this project, I even drafted a flow chart of the routines and file transfers. This clarifies my thoughts and sometimes saves my programmer time. It is not always easy for us to communicate: my programmer knows no accounting, nothing about budgeting or financial analysis, and I know no programming. So to the extent I use her tools, try to follow her logic, I can better communicate my needs.

There are other benefits to an ongoing working relationship. Having worked on other, smaller systems, I had a better idea of how to analyze a process into smaller, logical steps. Also, my office already knew something about expediting its owns jobs, which was helpful in testing the system. My office and BFDP had gained through experience enough trust in one another and enough tolerance of one another's areas of ignorance that we could help each other and save time finding errors.

BFDP handled the mainframe batch jobs, including providing files for us to download to the PC and accepting files from the PC. It took some trial and error for us to grasp the requirements for record length and field allignments. In moving data to the mainframe, it was critical to prepare print files with exact record lengths and to work with precise column widths, and to follow format requirements exactly. Often macros helped with this. In moving data to the PC, each number or label if properly separated from the others is treated as a different column regardless of the length of that number or label or the width of that column. So a label 20 characters long coming into a column 10 characters wide is nevertheless completely stored in that cell and can be displayed later if the column width is increased.

In addition to the file transfer problems at the mainframe end, BFDP handled mainframe jobs to spread the data and print reports, maintaining the existing interfaces with analytical and accouting systems. They did not need to concern themselves with what we did on the micro. We knew what we wanted and could specify which existing interfaces were to be kept, which micro hardware and software had to be used, and even the spread requirments for the batch jobs (by treating the old system as a rought draft).

I have said BFDP was responsible for the mainframe jobs, file formats for transmission, and interface to existing programs. The budget office staff tested and approved the mainframe jobs, comparing production costs with the old system. We had to meet BFDP's format specifications in entering and editing data for the mainframe. I developed macros to facilitate a lot of the data entry and edit. For example, we have a macro for inserting and formatting new lines. Staff members can choose whether to use the macros or not, increasing their sense of control over the system. The system functions as well for the staff member who knows little about a spreadsheet as for the staff member who understands it well.

I try to document as I go along. I don't write formal memoranda or procedures, but I do keep records of problems to be be resolved or requests made to be sure I don't forget to do something. Whenever I think I understood how something works, I write it up. For procedures within the office, such as micro routines or file transmissions, I make notes as I work. I distribute copies of the draft procedure to the office staff, and we correct the procedure as we test the routine. Thus the staff is not left out of the testing, and we always have up-to-date documentation. Staff members have individual copies and can add personal notes. I also archive a copy of all memoranda to departmental administrators, noting corrections for the following year.

The micro facilitates documentation through its word processing and print screen capabilities. I can give the staff precise, screen by screen instructions and examples to follow in logging on and running mainframe jobs. We print from screen copies of our on-line JCL in case we need to restore lines. It is easier to learn to run jobs and to make choices when you have your own copy of the screen with your own notes.

In the office, we used both detailed, step-by-step documentation and more general, summary documentation. The step-by-step mode helps start the inexperienced employee and should be maintained to explain exactly which choices to make on the mainframe and the micro. But the summary mode is also needed to explain what the individual choices mean and to avoid our getting lost in all the detail. These work tasks require employees to use a tremendous amount of detail which no one can learn without organizing it around some conceptual framework. This proved to be especially true of the most complicated procedure, transmitting files between the PC and the mainframe.

There were no classes in Lotus 1-2-3 on campus when we began using the system, and to some extent the staff was not yet willing to participate in general classes. In previous classes, they had found it difficult to relate general lessons to our specific work. Nor were they inclined to learn general spreadsheet principles from the tutorial or manual. So the detailed, step-by-step screens were extremely useful.

Most of their instruction was one-on-one with me. Many people are anxious about learning new things, but they are especially anxious about computers, whose detail and complexity are frustrating and threatening. Many people find it unpleasant to ask for help about anything, but it's especially unpleasant to ask about computers because the terminology is new, which prolongs the unpleasantness and complicates the communication. The situation is worse if one person in an office knows just enough to show off and adopts a "know-it-all" attitude when fielding questions.

In our office, the physical arrangement eased the learning process and let me function rather like a pair of training wheels. The XT's were near my desk so it was not necessary for someone to seek me out for help. I could enter into a helping conversation naturally by responding to staff members' comments. I encourged them to be patient. for it is hard to sense accomplishment when frustrated by the long process of assimilating a new system. Although I was looking over their shoulders, at least they could go ahead with what they were doing and call on me only when they needed me and for just as long as they needed me, since I was close at hand but otherwise occupied.

One of the best things about micro technology is that beyond a very few rules, there is much flexibility (especially in spreadsheet programs). One can work largely by trial and error, less bound by rigid protocol than in a mainframe environment. So the person who prefers to learn with a minimum of interpersonal contact can do so.

Written material in the micro environment is also more useful to the non-technical person, I think. I have never been able to obtain information other than the most elemental (how much cheaper are night jobs than day jobs?) from mainframe documentation. But micro software comes with well-written manuals oriented toward my point of view. And there are obviously good books readily available that are even more helpful than the manuals (which function as dictionaries, not textbooks).

While its micro components make this system easier to use, its mainframe components provide security and backup. Our programs are archived in the BFDP library with no effort by the budget staff, although we do keep a copy of on-line JCL to protect against our own expediting errors. When we update the budget files to the general ledger each month, an extra copy of the budgets is placed off line on tape to protect us from accidentally destroying the on-line budget files. The Computer Center maintains its own backup routine for all files, of course, in case of disaster. Thus our concern for micro files is only to protect very recent work. The tree-structure of our hard disks includes menus with simple backup commands for sub-directories so we need not back up the entire hard disk when only a part will do. We vary the backup schedule depending upon how frequently data is being updated. We also save an extra copy of each template under a different name to recover from accidentally writing over one. We were already used to saving work frequently on the mainframe, so it was easy to discipline ourselves to save critical data on the micro. (Although we do sometimes forget to protect irregularly used data.)

We did not parallel the old and new systems. Actually we began using the new one before it was completely written. However, at every stage of the project we had an alternate route available should we encounter a problem in the new system from which we could not recover. For example, we loaded the annual budget using the micro without knowing whether the spread routine would be finished to use this year, but we knew we could transmit a tape of the annual budget out to the other mainframe and spread the budget on the old system. This sort of security allowed us to use every moment in getting the system up and running this year.

DISTRIBUTION SYSTEM

A few departmental administrators with many budgets first approached me wanting budget data to eliminate keying. As I talked with users about their systems and needs, I was learning to use a spreadsheet myself and so could share problems and hints very productively. These conversations continued as the budget system developed. At the point when I had something specific to show and needed specific information from departments, I wrote to all the interested parties whom I could identify. To avoid overlooking some users, especially novice or potential users, I followed up the memo with calls and I enlisted the help of the academic budgetary offices.

In the memo and calls, I outlined what we proposed to provide and asked users to fill out an enclosed questionnaire. I also invited them to attend a short demonstration of our proposal. At this stage I already felt quite familiar with their needs, but I wanted to give them an opportunity to ask questions, particularly if they hadn't already talked to me. In addition to departmental administrators, I also invited representatives from on-campus programming groups and User Services. This was to introduce departmental users to Duke's resources, to facilitate the exchange of problems and solutions, and to quash any suggestion that I was trespassing upon anyone else's bailiwick. I cannot over-emphasize the importance of making the broadest possible contact. Despite my care to do so, I overlooked one programming group who would have been extremely helpful to me, and I failed to adequately involve one budgetary office far enough in advance.

During the meeting, I avoided promising data on diskette at a specific time. I explained our policy: that micro data would add to, not replace, hard-copy reports, and that we would support only IBM-compatible systems which could utilize a print file set up for Lotus 1-2-3. I can't do much about non-standard hardware, but I do talk to users and try to match up those who have similar problems or solutions to share.

Software is a little easier to address. Besides Lotus 1-2-3, the major spreadsheet in use is Multiplan, and the Computer Center's director gave me a utility which translates our files into Multiplan worksheets. Multiple translations accommodate users of dBase II and Supercalc. I suspect that a few users simply use the print files with a text editor. Actually there were few problems with incompatible software. Some users even based their software and hardware choices upon ours if they had especially strong interest in our data. This project contributed to the standardization of spreadsheets on the Duke campus, which benefitted the University by facilitating the sharing of information and by limiting the amount of software that the Computation Center has to support.

Some time after the meeting, we completed the preliminary spread. I then sent to all departments two copies of their approved annual budget, carrying a default spread. I asked each department to indicate errors or corrections to the budget, notified them that diskette spreads were coming soon, and asked those who wanted data on diskette to fill out a sheet concerning their hardware and software. Based upon those replies, we set up a production sheet for each department requesting a diskette. We provided the diskettes but asked the departments to buy transporters. We labeled the transporters and diskettes in a standard fashion and formatted the diskettes.

To produce diskettes, we had to group files by user rather than by our office's batches. We used our budget address system, which assigned address codes to expense funds, and we added selection by fund or component to accommodate revenue funds and special situations. We created an on-line "recipe" of each user's code selection, and ran a small batch job to select and format each user's files to be downloaded. The files were transmitted to the micro and copied onto diskette. Each diskette was placed in a transporter and sent out according to the label's instructions ("Mail" or "Call for Pickup"). We also distributed a hard copy, a memo explaining how to use the diskette, and any special instructions or files, such as the Multiplan

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utility. The first distribution included the current budget spread and the prior year's history files. In the upcoming budget cycle, we will distribute budget workpapers the same way, using the same "recipe" for each user.

I had initially anticipated distributing templates with macros and thought to have users pick up diskettes at the micro lab, so we could demonstrate the templates and macros. So far we have only distributed print files and left it to the users to import and use the data themselves. We may enhance the system to include some templates and macros later, now that more users are experienced.

We are adding other enhancements to our micro distribution. We hope to have monthly and biweekly payroll worksheets available on diskette for the upcoming budget cycle, and we will offer limited versions of the monthly analysis to departments. There is some likelihood of distributing data directly from the mainframe when more of our users have connected to DUCC and a policy to protect the data has been developed. The Computation Center director also demonstrated a utility to place personal computer worksheets (not just print files, but worksheets complete with formulae), on the mainframe for users to transmit to micros.

We are looking at ways to accelerate backing up micro files and transmitting files to the micro. Faster transmissions between the mainframe and the micro will require different software and possibly a different emulator board. The AT offers some promise and we will probably need a final micro. A nearby department has bought a dual-drive Bernoulli unit, so we are looking into adding single Bernoullis for additional storage and faster micro backup.

This application did not employ the most up-to-date technology, nor did it revolutionize our office. We continue to process essentially the same data and to distribute it in essentially the same way. But we have eliminated some duplicative effort, and we have begun to meet the needs of our departmental administrators. And in the process, our office has begun to take advantage of the microcomputer's flexibility without giving up the mainframe's power.

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DECISION SUPPORT SYSTEMS FOR STRATEGIC PLANNING

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Microcomputer-based decision support systems (DSS) were the backbone for the development in May, 1984, of the University of Miami's five-year strategic plan. DSS were critical to much of the information generated for the internal environment analysis, external environment analysis, and the financial modeling used to give quantitative substance to the goals and objectives.

Computer-generated enrollment and credit-hour projections were input into a financial model set up on a spreadsheet package to determine the effects of various combinations of parameters. The first iteration of the simulation utilizing the parameters would have put two schools out of business in five years! Later adjustments and modifications led to an incentive budgeting formula accepted by all deans.

This presentation will deal with the development of the University's five-year strategic plan utilizing computer-generated data and graphs as a foundation.

DECISION SUPPORT SYSTEMS FOR STRATEGIC PLANNING

The University of Miami is a private, independent, nonsectarian university which was chartered in 1925 as a nonprofit institution of learning, whose policies are established by a self-perpetuating Board of Trustees. The University serves more than 13,500 students each year, 9,000 of which are undergraduates. President Edward T. Foote II, who came to the University of Miami in 1981, demonstrated his commitment to planning by undertaking a major strategic planning effort. At the end of 1983, he reorganized Planning and Institutional Research (PIR) as an adjunct to Information Systems.

The Strategic Planning Process

The first phase of the University of Miami's Strategic Planning, in which each school/college and support area prepared a planning report, was completed in June, 1983. The plans written at this time were at the level of individual units rather than for the University as a whole. Included in this phase was a Cost Study that revealed which schools/colleges within the University were being subsidized at the expense of other schools/colleges. In the Cost Study, tuition revenue is allocated by using a weighted average of 55% of teaching credit hours (based on courses taught by a given school/college) plus 45% of home school credit hours (based on courses taken by majors in a school/college). Indirect costs from the support areas are allocated to each revenue-producing center using a variety of formulas.

The second phase, in which synthesis and university-level planning was carried out, was begun in January, 1984, with a date of April 28 for presentation to the Board of Trustees. Volume One of the plan describes the Mission Statement, Guidelines for Planning, Internal Environment, External Environment, Goals and Action Plans, and a Financial Plan for the entire university. Volume Two describes these elements for each school/college and support area within the University. At the heart of the Strategic Plan is an Incentive Budgeting system utilizing the techniques developed during the Cost Study. This fall the University is in the process of updating the strategic plan as part of the budget process for next year.

Decision Support Systems

A decision support system is a computer based system that transforms and reduces data to information that is useful for an executive decision maker. The University of Miami utilizes three major decision support systems in its planning process.

Micro-generated graphs. The first of these systems was micro-generated graphs (created by using an Apple Lisa) to summarize data about the internal and external environments of the University. Since this was the first such strategic plan for the University of Miami, a large set of data had to be collected and assimilated as part of the planning process. The use of graphs proved to be the most effective way to present large amounts of data to key executive officers of the university (Exhibit 1).

Some of the most useful graphs were those comparing the University of Miami with other colleges and universities. In Spring, 1984, the NCHEMS Information Services was used to obtain comparative data for the University of Miami and twenty other selected schools (Exhibit 2). This fall the Chronicle of Higher Education Data Service diskettes and Lotus 123 are being used to prepare comparative data. Lotus 123 was selected for its flexibility in allowing the selection of exactly the universities and variables desired for each analysis. For example, College Board application, acceptance, and enrollment data for twenty selected schools are being used to compute acceptance and yield rates from the data supplied. These data will then be put into graphed format.

Projection Models. The use of computer models to project enrollment, credit hours, and indirect costs was the second major decision support system utilized in the planning process. This past summer and fall, FIR replaced its large, slow, and cumbersome mainframe programs that had been used to generate estimates of future headcounts and credit hours with Lotus 123 models. During the development of the new models the University of Miami had the good fortune to serve as a beta test site for the Decision Support System Demonstrator models developed by NCHEMS. We borrowed ideas from the NCHEMS models and modified them to suit Miami's unique situation. Lotus 123 was an extremely useful tool for the "what if" statements necessary for the incentive budgeting process which allocated resources within the university.

Historical data for three years for headcounts and return rates were entered into the Lotus model for each of twelve schools and colleges within the university. The Provost used these historical data and information from the External and Internal Environment analyses to decide upon preliminary projections of new students for each of the schools (Exhibit 3). These projections were then passed on to the deans, who had the opportunity to modify them.

As indicated earlier, projected tuition revenue is a function of projected teaching and home credit hours. To compute projected credit hours, the model simply takes current crossover patterns for credit hours and multiplies them by the ratio of projected to actual students (Exhibit 4). The projected tuition revenue is then passed on to the Assistant Vice President for Budget so that it can be included with other sources of revenue, direct costs, and indirect costs to get a bottom line figure for each school/college.

Although the Cost Study indicated that certain schools were not generating enough revenue to cover expenses, a preliminary run of the models projecting credit hours, revenue, and expenses made it clear that if enrollments were as originally projected, either the university would have to continue to subsidize the schools or they would go out of business at the end of five years. The decision was made to continue to subsidize only the Rosenstiel School of Marine and Atmospheric Science and the School of Music.

The projected revenue expenditure gap over five years indicated that two schools in particular, Education and Nursing, would have to be especially innovative in reorganizing their schools and instructional programs. The School of Education has reduced faculty by over twenty percent and is phasing out its undergraduate program. New students who want a teaching certificate will enroll in the College of Arts and Sciences and then take courses in Education. Nursing is looking to build up its graduate program through state contracts so that it can cut back at the undergraduate level. Of course the plans from last spring are in the process of being updated this fall and will continue to be every fall.

PERT/CPM. In any planning process, problems of scheduling and responsibility are inherent. At the outset everyone knew that the schedule would be very tight because of a decision to present the Strategic Plan to the Board of Trustees at their April meeting. Last spring, a schedule was developed at the beginning of the process, but at the end, responsibilities had to be shifted to get the work done.

In order to avoid these problems this fall, PIR used a third major decision support system, Program Evaluation and Review Technique (PERT)/Critical Path Method (CPM). The PERT/CPM package of the Apple Lisa was used to develop a detailed schedule which attempted to spread out responsibilities over time and to chart critical paths (Exhibit 5).

Recommendations

Experience in developing a Strategic Plan last spring and updating it this fall has led to the following conclusions and recommendations:

1. Investigate all assumptions in the model, explicit or implicit. The quality of any decision support system is directly related to the quality of the logic and assumptions that underlie it. Often implicit assumptions are not immediately apparent. For example, at the University of Miami, projections for spring and summer sessions are computed as ratios of the fall. Originally it was implicitly assumed that all schools had the same ratios. This fall, when ratios were computed for each school separately, it was found that, on the contrary, ratios varied among the individual schools but remained relatively stable for a school from one year to the next.

2. Avoid acquiring a "set" when developing the model (i.e., a tendency to approach a new problem in the same way an earlier one was approached). In the development of the enrollment and credit hour models using Lotus 123 and an IBM PC, the complex structure of existing programs which ran on a UNIVAC 1100 mainframe had to be rethought. The old enrollment model required the input of almost two hundred variables for each of twelve schools/colleges. The new model requires the input of fewer than 40 variables per school. In spite of the larger number of variables in the original model, however, it is actually less accurate than the new one when it comes to predicting headcounts because the logic had not been well

thought out in the original model. A close examination of the original model revealed that some students were double-counted while others were not counted at all. This showed that complexity in and of itself does not guarantee accuracy of a model. Logic and underlying assumptions are far more important.

3. Garbage in garbage out is still an axiom. Any model is only as useful as the data upon which it is built. Often insufficient time and effort are put into collecting and checking data. In the original model inherited by PIR, for example, adequate care had not been taken in distinguishing between students in special programs and those paying regular tuition. This mistake affected the allocation of tuition among schools.

4. Build in internal accuracy checks whenever possible. The accuracy of data for University of Miami's enrollment model is tested by using the model to "predict" totals for historical data and then comparing these with actual totals. This technique not only allows typos to be caught, but it is also an accuracy check for the model itself. In addition, it is important always to give any output a subjective, "Do these numbers 'feel' right?" kind of check.

5. Keep all models as simple as possible. The model will be easier to develop, debug, use and explain. One of the problems with PIR's original program was that it was too complex. Perhaps one of the most important benefits of simplicity, though, is that the model is now easier to explain. When the model was reduced from 200 variables per school to 40, it was felt that maximum simplicity had been attained. However, Deans still found the model too complex. In the future, Planning and Institutional Research will reduce the amount of paper that is sent to the Deans. Remember your audience. Keep models simple and short. Users will be less overwhelmed. If it is necessary to build a more complex model, do it modularly. The University of Miami's model was divided into two pieces, an enrollment model and a credit hour model--which simply extracted data from one model to feed into the next.

6. Involve as many people in the development of models as possible. In this way the model will do what the users want and they will have been given "ownership" of the project by being included in its creation. There is a revolution in planning and computing resulting from the proliferation of microcomputers. The Long Range Academic Systems Plan of the University of Miami "envision[s] a University in which computers are pervasive and ubiquitous." As a result, data will be directly available to more people. They can be more constructively involved in planning by having these data available in a useful and uniform mode.

7. Be flexible in your approach and be willing to change the model as it is developed. Pride of authorship is not a good trait for model building, especially for any model that will be used by others. Allow for changes in the entity that is being modeled. For example, this fall a new School of Communication was included in the model in anticipation that it would be approved by the

administration and Board of Trustees in the middle of the strategic planning update this fall. It would be easier to recombine Communication with Arts and Sciences if the new school were not approved than it would be to pull all of the data out separately in the middle of planning if the new school were approved. Allow for different approaches by different users. For example, some deans approached enrollment projections from the point of view of numbers of new students whereas others were more comfortable projecting total enrollments. For the latter deans, the numbers of new students were calculated to give them the total enrollments they wanted.

8. Select the correct hardware and software for any model that is developed. The original enrollment models that were inherited by PIR were written in Cobol and in SPSS to run on a UNIVAC 1100. It not only took two weeks to collect and enter data for the models, it took a long time to run them. Once, when the credit hour model was run "interactively" instead of "batch," it took five hours to run and degraded the use of the computer for concurrent users. Batch runs had overnight turnaround. The old model was also much less flexible than the new one. The reason for all of the problems was that the wrong hardware and software were being used. Now, more accurate results are obtained using Lotus 123 on an IBM PC, and in less time. It was possible to enter a set of assumptions, run the model, print and copy the results, and return it to the Provost in less than two hours.

   PIR has re-evaluated hardware and software for graphing. Although the quality of graphs on the Apple Lisa was satisfactory, future graphs will be made using Chartmaster on the IBM PC so that data can be exported from Lotus 123 to Chartmaster instead of being re-entered. The capability of using an Irma board to download from the mainframe to graph on the PC is also available. Because each of the staff members in Planning and Institutional Research has his/her own PC, there are automatic backups.

9. Pay attention to the form of the model as well as its content. Obviously any decision support system is of little use if it is not well thought out, but it is also true that it will not be used if it is not well laid out. Decision Support Systems are used by executives with a limited amount of time and often limited amount of interest in detail. At the University of Miami, a great deal of time was spent thinking about and modifying layout. One idea, which was borrowed from the NCHEMS DSS Demonstrator, was to use a screen orientation to set up the Lotus 123 model. Since each screen had its own titles and row and column headers, it was easy to turn out reports by simply printing the screens.

10. Ask "what if" questions. For example, what level of new students is needed to increase enrollment? What increase in retention rates will accomplish the same enrollment? What is the trade off between new freshmen and transfers? The projection of total enrollment is actually a complex process, one which the unaided human mind cannot handle easily. A computer model allows the executive decision

maker to see the consequences of certain assumptions and to adjust the assumptions if the consequences turn out to be too surprising.

11. Monitor the flow of information and the ordering of steps in the planning process. Make sure that earlier decisions do not unduly constrain later ones. For example, last spring graduate enrollment projections had to be kept constant for one year because constant graduate enrollment had been assumed in the budget approved by the Board of Trustees earlier. This year Strategic Planning is being updated in the fall prior to budget decision to avoid this type of problem.

12. Do not let the Decision Support Systems make the decision instead of merely informing the decision maker. This fall, when an initial run of the enrollment model showed enrollment increasing over five years, the subjective feeling was that a more conservative forecast was in order. The assumptions about new students were adjusted accordingly. The result was a projected decrease in enrollment. This has since been adjusted upward by increasing the return rates.

The Future

PIR has several plans for further developing these decision support systems in the future. First, computer models that are currently being used will be expanded. Next year, the model will include special programs in addition to regular tuition projections. At the present time, the bridge between the enrollment/credit hour models and the cost study model is a paper one; in the future it will be through diskette.

Second, PIR plans to make the school-level enrollment models available to deans. Furthermore, PIR will provide each school and college with their own data base on diskette, downloaded from the central data base, since on result of the planning process was that deans began to ask new questions about data in the central data base. In addition to the data themselves, each dean will receive basic tools and models for evaluating them.

Third, now that the basic models have been developed, less time will be devoted to implementation and more to reflection. PIR will use the model to ask more "what if" questions and explore different options. Making school models available to deans will allow them to ask "what if" questions at the school level.

Fourth, PIR will try to be more proactive and less reactive. In the year since PIR was reorganized, attention has been focused on writing the strategic plan in the spring, developing new data bases and models in the summer, and then updating the strategic plan in the fall. In the future PIR will devote more time to finding out what other universities are doing and initiating new studies.

Fifth, at the University of Miami Strategic Planning is seen as an on-going process, not something to be done once and then forgotten. The updating process includes a section on the status of goals and action plans devised at an earlier time.

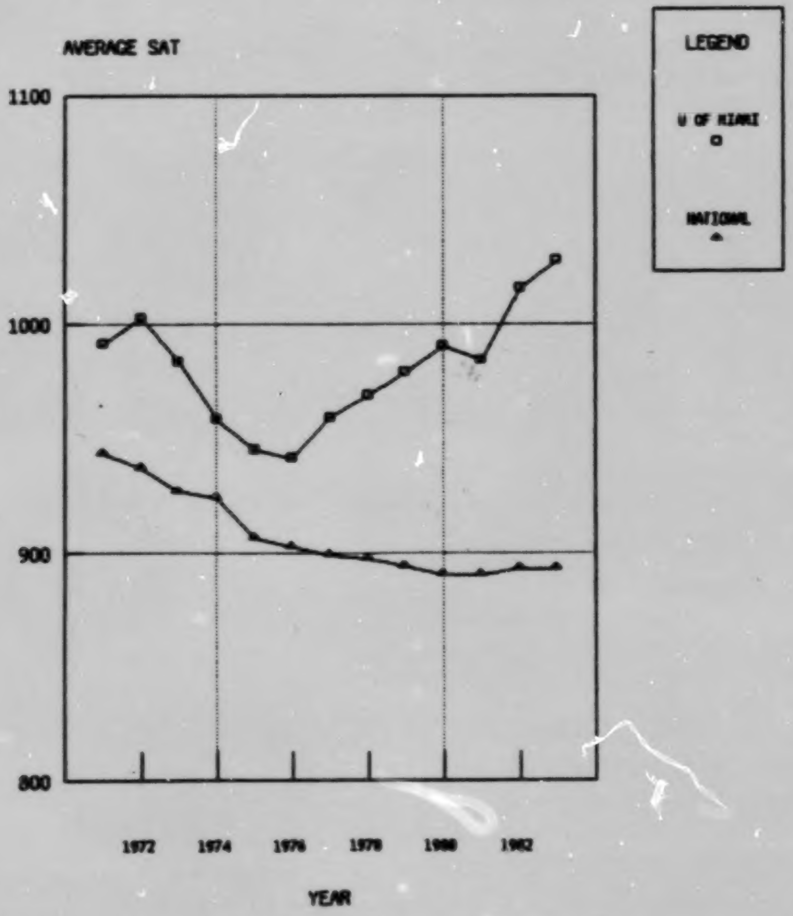
The University of Miami has found strategic planning to be a very helpful process for a variety of reasons:

- Developing Decision Support Systems led to a clearer understanding of the process that was being modeled. Certain assumptions that previously had been hidden were made explicit and sometimes changed.
- Modeling has led to more standardization among the schools and colleges in the university because they are provided data from the same model in the same format. At the same time, however, it has permitted flexibility to handle differences in approach among the deans.
- Planning can be done more quickly. No extra time is needed for typing reports and proofing the numbers in them.
- A by-product of developing the new enrollment model was that it was also possible to clean up some problems with our central data bases not even realized previously.

Strategic Planning has become an essential and ongoing function at the University of Miami, and Decision Support Systems have played a central role in the planning process. The added insight, standardization, speed, and accuracy that they provide make them invaluable tools. They, like the plans that they support, should be continually re-evaluated and improved.

MEAN SAT SCORES OF NEW ENROLLED FRESHMEN

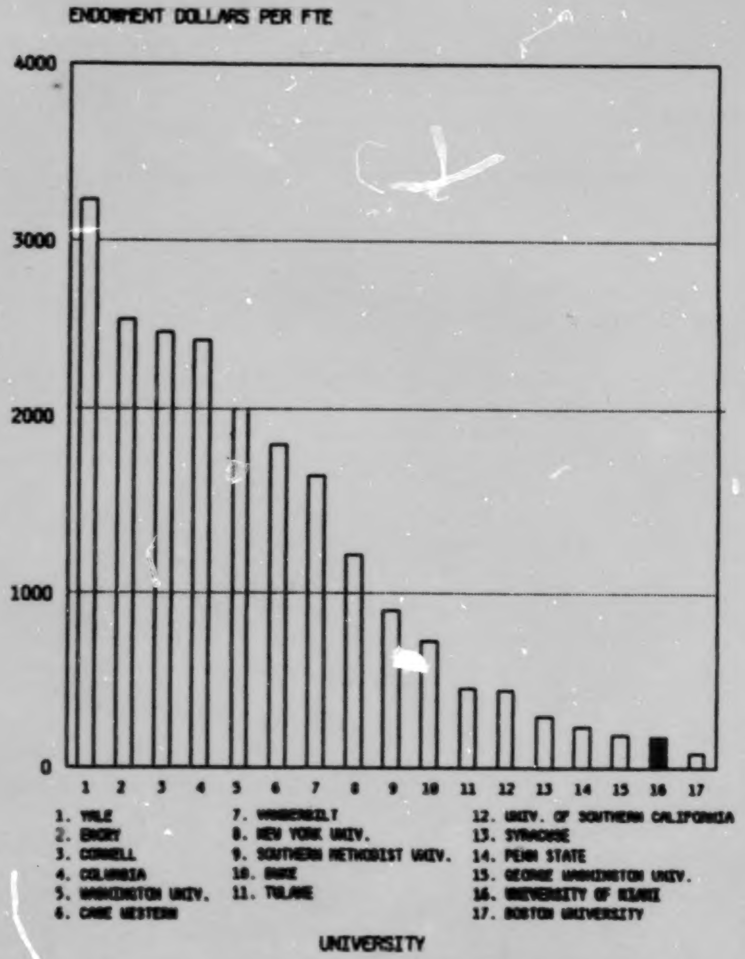
UNIVERSITY OF MIAMI COMPARED TO NATIONAL MEANS



SOURCE: UNIVERSITY OF MIAMI FACT BOOK

EXHIBIT 1

ENDOWMENT INCOME PER FTE STUDENT
FOR UM AND REFERENCE UNIVERSITIES
FISCAL YEAR 1981-1982



SOURCE: HOVERS INFORMATION SERVICE, FISCAL YEAR 1984

EXHIBIT 2

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ENROLLMENT MODEL

SCHOOL A SUMMARY for FALL Semesters--Headcounts and Return Rates

	<-----ACTUAL----->			<-----------PROJECTED---------->				
TOTAL STUDENTS	1982	1983	1984	1985	1986	1987	1988	1989
Degree UG	1344	1299	1298	1283	1283	1284	1288	1291
Non-degree UG	0	0	0	0	0	0	0	0
Graduate	173	194	178	175	173	172	172	172
NEW STUDENTS								
Degree UG	377	343	415	399	399	399	399	399
Non-degree UG	0	0	0	0	0	0	0	0
Graduate	79	93	61	65	65	65	65	65
RETURN RATES	<-----ACTUAL----->			<-----------PROJECTED---------->				
(FALL TO FALL)	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89
Fresh. Returning	NAV	61.1%	59.8%	59.8%	61.3%	61.6%	61.9%	62.2%
Soph. Returning	NAV	62.0%	70.5%	70.5%	71.2%	71.6%	71.9%	72.3%
Jr. Returning	NAV	80.1%	79.2%	79.2%	79.2%	79.2%	79.2%	79.2%
Sr. Returning	NAV	33.0%	32.1%	32.1%	32.1%	32.1%	32.1%	32.1%
NDUG Returning	NAV	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grad. Returning	NAV	40.0%	46.4%	46.4%	46.4%	46.4%	46.4%	46.4%

EXHIBIT 3

CREDIT HOUR MODEL

SCHOOL A Projected UNDERGRADUATE Credit Hours TAUGHT in Fall 1989

	<-----UNDERGRADUATE TEACHING CREDIT HOURS----->							TOTAL
SCHOOLS	FRESH	SOPH	JUNIOR	SENIOR	NDUG	GRAD	TOTAL	HOME
Architecture	40	150	155	154	0	0	499	402
Arts & Sciences	208	106	124	118	0	30	586	6619
Business	6	3	15	14	0	9	47	772
Communication	0	0	0	0	0	0	0	89
Contin. Studies	0	0	0	0	51	0	51	0
Education	0	0	0	0	0	0	0	150
Engineering	1837	1605	2702	4474	0	46	10664	10664
Internat. Stud.	0	0	0	0	0	0	0	0
Med. Graduates	0	0	0	0	0	6	6	3
Music	108	63	91	117	0	0	379	428
Nursing	0	0	0	0	0	0	0	0
RSMAS	0	0	0	0	0	0	0	0
TOTAL TEACHING	2199	1927	3087	4877	51	91	12232	
TOTAL HOME	5145	3761	4177	5981	0	63		19127

Total Projected FALL UNDERGRADUATE TUITION REVENUE (in 000's) XXXXXXX

EXHIBIT 4

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STRATEGIC PLAN UPDATE

PERT CHART 9-13-84

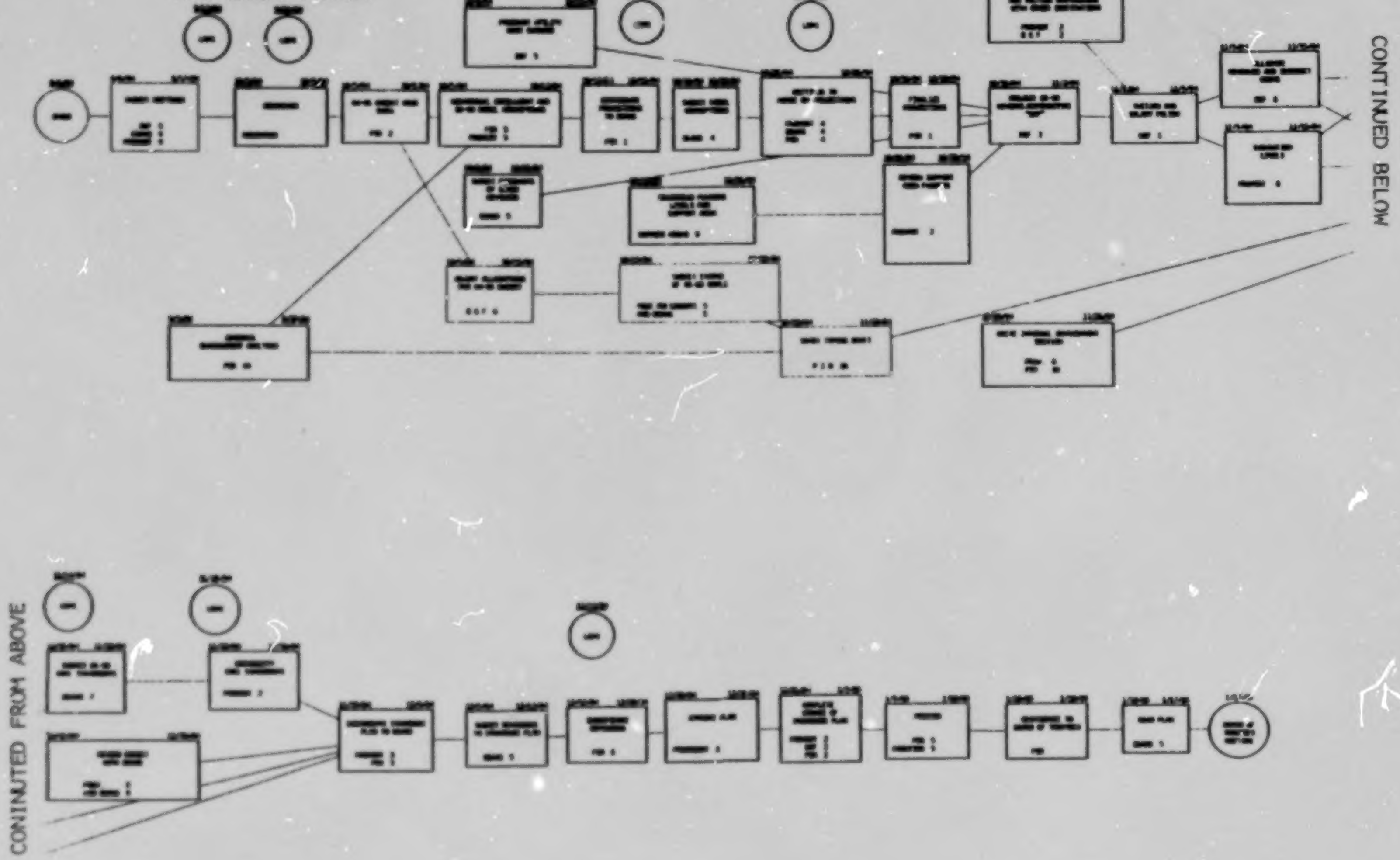
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EXHIBIT 5

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A Personal Computer Information Centre

McGill's Experience

Derek M. Remsen
Manager, Support Services
McGill University

I. INTRODUCTION

The Hon James McGill, a leading merchant and prominent citizen of Montreal, who died in 1813, bequeathed an estate of forty-six acres called Burnside Place together with 10,000 pounds to the already existing 'Royal Institution for the Advancement of Learning' upon condition that the latter erect "upon the said tract of parcel of land, an University or College, for the purpose of education and the advancement of learning in this Province", and further upon condition that "one of the Colleges to be comprised in the said University shall be named and perpetually be known and distinguished by the appellation of McGill College'".

The Royal Institution, although authorized by law in 1801, had not at that time been created but was instituted in 1819. This body obtained in 1821 a Royal Charter for a University to be called McGill College. Further delay was occasioned by litigation, and the Burnside estate was not acquired until March 1829. The Montreal Medical Institution which had begun medical lectures at the Montreal General Hospital in 1822 was accepted by the College as its Faculty of Medicine in June 1829. After further litigation, the College received the financial endowment in 1835 and the Faculty of Arts opened its doors in 1843.

Progress, however, was slow until the 1821 Charter was amended in 1852 to constitute the members of the Royal Institution as the Governors of McGill College. Since that time the two bodies have been one. The older style was 'The University of McGill College' but in 1885 the Governors adopted the name 'McGill University'. Even after the Amended Charter was granted, little advance was made until 1855 when William Dawson was appointed Principal. Under his leadership, McGill admitted its first female students in 1884, making this year a centennial one. When he retired thirty-eight years later McGill had over one thousand students. The Molson Hall, the Redpath Museum, the Redpath Library, the Macdonald Building for Engineering and Physics and a fine suite of medical buildings had been erected.

Since 1893, the University has continued to grow vigorously. It now comprises twelve Faculties and nine schools. In 1899, the Royal Victoria College was opened, a gift of Baron Strathcona, to provide separate teaching and residential facilities for women students. Gradually, however,classes for men and women were merged, and now the University is wholly coeducational. At the same time, McGill was very instrumental in expanding higher education in western Canada. Between 1903-1914 Victoria College in Victoria, British Columbia gave McGill courses and later became the University of Victoria. In 1906, the McGill University College of British Columbia was established and in 1916 became the University of British Columbia. In 1908, a McGill professor moved west and founded the University of Alberta. In 1907, Sir William

Macdonald established Macdonald College at Ste Anne de Bellevue, Quebec, as a residential college for Agriculture, Household Science, and the School for Teachers. This last is now the Faculty of Education and located on the Montreal campus. The University's general development has been greatly facilitated by the generosity of many benefactors, great and small, and particularly by the support of its graduates, for regular public funding for general and capital expenditures did not become available until 1963. Since that time Government grants have become the major factor in the University's financial operations, but it still relies on private support and benefactions in its pursuit of quality teaching and research.

At present some twenty thousand students are taking regular university courses, of these some 23% have french as a mother tongue. Of our 90,000 living graduates, 14% reside in the United States and another 18% reside overseas, thus showing the international flavour of the McGill community. New buildings have been erected or acquired to provide the undergraduate and research facilities needed by the increased student body, and include residences, gymnasium, swimming pools and winter stadium as well as a University Centre and a concert hall.

The University is also active in providing courses and programs to the community through the Centre for Continuing Education where over thirteen thousand students are registered.

McGill's annual budget now exceeds $240 million Canadian.

2 COMPUTING ENVIRONMENT

McGill has always had a large IBM-architecture mainframe approach to general purpose computing. Currently the Computing Centre runs a 24 megabyte Amdahl 5850 with an IBM 4341 connected channel to channel. Both run under VM, with the 4341 supporting MUSIC, and the Amdahl running MUSIC and MVS with IMS, TSO/ISPF, Mark IV and V. Administrative work makes up about 40% of the total, varying with the time of year, with the balance from teaching, research and commercial work.

In addition to this main Computing Centre, there are VAX installations in a variety of specialised areas such as Computer Science, Electrical Engineering and Biomedical Engineering, and a large number of PDP minis scattered about in research labs. We also have many thousands of cows from Quebec, the Maritimes and points west plugged into our Dairy Herd Analysis System on another 4341.

Distributed RJE stations and terminal rooms service students, plus terminals for researchers and administration, with a total of around 2000 devices.(Hopefully not all active at once.)

The downtown campus is hardwired wherever we can get an underground coax or twisted pair, with a Gandalf PACX system handling these twisted pairs and our dial up lines.

Computing at McGill is therefore fairly typical of medium/large sized research-oriented institutions.

Organisationally, the Computing Centre reports to one VP, we report to the VP Administration and Finance. In Management Systems we have approximately 25 professional programmers, analysts and managers, plus data entry and RJE operations staff - and of course the Information Centre.

3 NEED FOR MICRO, WP SUPPORT

By early 1981, it was clear that there was a need to do SOMETHING about micros on campus before chaos set in. Not that there were very many micros installed at that time, indeed there were none in Administration, but there were obviously going to be many soon. We looked at a number of machines with a view to standardisation, for example the TRS-80, and the Apple II, but decided to wait for something more substantial with better mainframe connection possibilities.

In the Fall of 1981 after the IBM PC announcement we decided to support that as the standard micro. Together with the Computing Centre we announced that the PC would be supported, in terms of advice, bulk buying, software package evaluations, and mainframe connections. We did not say that users could not buy anything else (that would never fly at McGill), just that the PC was the preferred choice, and that no guarantees of support were made for any other micro.

There were several reasons for settling on the PC at that time:

- it was an 8/16 bit machine, with the potential for more memory, and the prospect of more speed than most others at the time;
- compared with available alternatives, the quality of the monitor and of the keyboard was good;
- it was an open system, with the likelihood of many hardware add-ons;
- IBM were openly encouraging software authors, suggesting that there would be a lot of packages written for the PC;
- IBM had adopted a multi-channel distribution system, with product centres, dealers, and direct sales, giving competition in the marketplace;
- IBM seemed to have gotten it right;
- it seemed unlikely that IBM would go broke.

With all these virtues, it was clear that this was a good choice, which might become popular - we expected to see a dozen or so over the next year. I remember that in 1982 we agonised over a commitment to buy 20 PC's to quality for a quantity discount.

The rest is history. Demand from researchers soared. PC's became unobtainable. Even IBM grossly underestimated PC demand, for example in November 1982 they estimated 1983 total sales in Canada of 4,000 units. They sold 6 times more - no wonder we couldn't get them at any price.

By mid 1983 it was clear that the numbers of PC's were taking off - there were more than 200 in place, mainly in research. Many were in McGill's 6 associated teaching hospitals. On the other hand, there were few in teaching areas, due mainly to academic inertia and some lack of teaching packages outside business. Indeed the only PC teaching lab to-date has been in the Faculty of Management, although one is now being funded for Education.

Administrative departments were fairly quick to recognise the value of PC's, particularly for spreadsheet work. We initially handled support for these users in an ad-hoc way using our local micro expert. We soon realised that the micro support workload was growing so quickly that we needed to do something more formal to prevent our traditional work from being swamped.
We therefore agreed with the Computing Centre that they would buy hardware, and assemble the bits and pieces for any campus user, that we would order systems through them, and that they would support academic users and uses, whilst we in Management Systems would support administrative users and uses.

In the Fall of 1983, one year ago, we developed a formal proposal to establish a micro Information Centre to support administrative users of micros, and to support academic users of "administrative" packages.

4 INITIAL OBJECTIVES FOR THE INFORMATION CENTRE

The original mandate set for the Information Centre when it was proposed was as follows:

"To provide training, consulting and technical assistance to the McGill community in the application of end-user computing tools for administrative applications."

Note that this was a broad mandate. It was not hardware specific, it included any end-user tool (hardware or software), including WP, it was not limited to Administration departments but included "administrative" tasks anywhere, and it covered the "McGill community", which certainly included our teaching hospitals, and could be expanded or contracted as we saw fit.

Benefits anticipated included :

- off-loading work from regular Management Systems staff, releasing them for their traditional work;
- giving a focus for users to turn to for help;
- improving users' productivity;
- giving users access to their own data;
- enhancing our image.

Staffing was to be 1 professional (our micro buff), with 1 clerical support person.

Financing was to be on a break-even basis, with income from some chargeable activities and the off-loading of other Management Systems staff balancing the staff costs - the usual smoke and mirrors approach.

We had at least 3 choices for the physical location - in the Computing Centre (where the disadvantage was the mainly academic or at least un-business like atmosphere), with Management Systems in Administration, or on neutral ground. Our choice was to keep the Information Centre in Management Systems both organisationally and physically in Management Systems to maximise the spin-off benefits to old-line DP mainframe professionals.

We initially expected that the Information Centre would provide a mix of free and charged services as follows:

Free
- advice on appropriate tools (hardware and software)
- assistance in the acquisition process
- installation help
- telephone hot line

Chargeable

- seminars
- consulting for more extensive help (not programming)

5 EXPERIENCES

It took us a little while to get the Information Centre up and rolling, to release the two staff members from their previous work, and to organise the space, so that the formal opening wasn't until March 1 of this year. After a 2 month start up phase we began full service May 1. Since then we have run into a number of problems which many of you will recognise.

SPACE - the decision to keep the Information Centre in Management Systems meant that space was limited. In the Information Centre we try to provide a closed room (actually cell is a better word) for self-paced tutorials for people to make fools of themselves in private, space for two full time staff (soon to be three), space to receive clients, space to show off a range of hardware and software, and space for our collection of journals. It's a struggle in 368 square feet (it's even more of a struggle in square meters!).

SEMINAR FACILITY - initially we ran our internal seminars in the student PC facility I referred to earlier. This was not very satisfactory since not only could we only book it outside term time, but also it was spartan in finish, and poorly equipped. Not a professional facility. We have recently moved into a facility shared with the university's Management Institute, which is more professional in appearance, although it's still not up to the standard of some private training facilities.

FINANCING - The challenge to break-even financially has forced us to re-evaluate our free services. We initially expected that deliveries and installations would be in the Administration Building, but once the community found out about the service we began to get requests from people all over campus and in several hospitals, who were happy to pay a reasonable amount for quality service. We now provide pick-up, delivery and installation of anything from a card to a full system for flat fees on the main campus, and on a per hour basis off campus. Our scale of charges is attached.

MATERNITY LEAVE - Shortly after we began planning for the new functions, it became increasingly clear that our clerical support person had expansion plans of her own. Fortunately we have been able to hire two final year undergraduate MIS majors out of our Information Centre Manager's micro course as part-time casuals to cover the gap.

WORKLOAD - The growth has been enormous. Some statistics of the major activities are attached. An extra full-time position of Trainer/Junior Consultant has now been funded for 1 year out of profits from equipment sales to help. Our hope is that the extra revenue will generate enough surplus to pay for the position permanently. We are hiring one of our casuals for this work, and we hope that she will be out giving seminars and consulting enough that she won't need a desk!

CONSULTING - Our initial approach was to have several of our most senior systems staff doing this on a rotating basis. This did not work out too well, as other pressures from their regular work began to intrude. We did benefit from some technology transfer, and attitude changes, as they saw better what micros could do. We have now moved to have 3 less senior staff handle this on a 1/3 time basis each.

SOFTWARE PIRACY - Copyright laws in Canada are weak in the software area. Otherwise upright, law-abiding citizens who would be appalled by people cheating, or copying books, are turned into unscrupulous savages when given a chance to copy a package which would otherwise cost several hundred dollars. We have even had a case of a medical doctor taking program diskettes overnight from a seminar and copying them. Resolution of this problem isn't easy, but the climate does seem to be improving.

WORD PROCESSING (as in standalone WP units) - We had hoped that the Information Centre would get more involved with WP issues. Time hasn't allowed this, but as more and more people have both dedicated WP stations and micros and want to connect the two, we expect more involvement. We are pursuing a hardware/software solution to interchangeability from Keyword Office Technologies in Calgary, Alberta, and available from their US subsidiary in Silicon Valley.

6_USER_SERVICES

Today, the services provided by the Information Centre include :

- Advice on configurations - we have a "standard configuration" as a starting point, and a price list of add-ons.

- Pick-up, delivery and installation - we have now installed over 60 systems. McGill now has more than 600 PC's in total, plus approximately 100 other micros, mainly Apples, and 100 WP workstations (mainly AES (Lanier)). Delivery time is around 4 weeks depending on configuration. Systems are built up by the Computing Centre, who are always running out of something.

- Seminars - we are now giving one or more every week, including:

  - Introduction to the IBM PC

  - WordStar for beginners

  - Advanced WordStar

- dBASE III
- Lotus 1-2-3
- CrossTalk
- Symphony
- Framework

The most popular is the Introductory seminar, followed by WordStar for beginners and dBase III. The least popular are the integrated packages (perhaps the packages are too difficult or expensive for beginners, whilst 'experts' think they don't need help.

- Consulting - as mentioned already, we have not done as much as we would like, mainly due to the lack of people, not to lack of demand.

- Software sales - these have been every active, but there's no money in it. Most vendors don't seem interested in educational institutions apart from cheap publicity in the classroom. We publish an official list of sold/supported packages.

- User group meetings every 2 months. Initially these were well attended, less so now (perhaps users are more experienced, and don't feel need.)

- Newsletter - a brief bi-monthly list of new items, seminars, cries for help, etc.

- Software research - we try to keep up with advances of potential interest to our user community, but this is extremely time consuming just reading about them, never mind evaluating new products/releases. We have split the job up in attempt to do it better, so that different people handle word-processing, spreadsheets and database packages.

OTHER ACTIVITIES - specific projects are done as time permits, e.g. a review of micro/mainframe links, with a trial of Answer/DB (conclusion - works as advertised - cost/benefits not there for us at this time)

QUESTIONNAIRE - a recent survey sheds light on the typical Information Centre user who answers questionnaires. Of the 44 respondents, almost 90% were administrative, 50% were teaching or research (and 40% were probably schizophrenic). 50% wanted a link to the mainframe, 25% didn't, and 25% didn't understand the question. Over 3/4 were using WordStar, over 1/2 Lotus 1-2-3 and nearly 40% dBASE II or III. Everything else was an also ran.

INFORMATION CENTRE EQUIPMENT - At present we have a Columbia Portable for overnight loans (including several loans to the Principal), 2 PC's, an XT, and a variety of printers.

SUPER USERS - no survey of our Info Centre would be complete without mention of the growth of "Super Users". As micro knowleddge spreads, we are finding that certain users are becoming extremely proficient in various aspects of micro applications, to the extent that we refer other users to them as experts in their areas. One of them does our 1-2-3 seminar. As micros proliferate we expect (and hope) that this will happen more and more.

7 CONCLUSIONS

7.1 Micro support is a vital operation for today's administrative computer group.
7.2 The need is changing very quickly as the micro scene (and the user base) expands and matures.
7.3 A formal Information Centre is the best way we know to handle the need for today.

7.4 To do it properly needs a major resource/time commitment.
7.5 To do it properly needs staff who are people-oriented, and the manager must be an entrepreneur.
7.6 We're happy with ours, and we're expanding it.
7.7 Next year the micro scene will be different from now, and so will the Information Centre.

8 RECOMMENDATIONS

DO IT! It can be a relatively low cost (if you charge back) way of providing the support your institution needs. Smaller institutions may need it more, depending on micro support in the local

community.

If you want some advice, and like skiing, come and see us.

If you don't like the cold, we'll come see you - for a fee!
But one thing you must do is to get a round tuit. And here's one.

Thank you.

BIBLIOGRAPHY

Keen, Peter and Woodman, Lynda What to do with all those Micros, Harvard Business Review, pages 142-150, September-October 1984

Young, Laurie, The 'in' place to buy micros, Computerworld In Depth pages ID/31-34, November 5 1984

OPTIONS FOR EDUCATING MICROCOMPUTER USERS FOR MAXIMUM EFFICIENCY

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This paper traces a brief history of the educational processes incorporated in todays microcomputer education programs. A number of delivery options are examined for their abilities to deliver the course content in a manner which will allow the person receiving the instruction to integrate the instruction into their work situation in the best possible manner. Also covered are some options for the location of the instruction, the course content, and evaluation of such courses.

Historical Perspective:

The full impact of the microcomputer influx into education and industry is only beginning to be felt. The first stages of the onslaught are about completed and the orchestration for the second wave is well in place. The middle and upper level management personnel who were among the first to embrace the microcomputers and their elemental forms of software are now those who are in a position to recommend to others the types of machines and software to be purchased in addition to suggesting the most efficient ways to achieve desired goals through microcomputer use.

The most elemental stages of the development of microcomputer usage could be divided into two "happenings". The first of these "happenings" was that a wave of gamers emerged as a separate unit from the mainframe devotees. This group was composed mainly of the remote users who had access to a mainframe on which someone had secretly placed a copy of Adventure, Zork, or one of the earlier versions of Star Trek.

This group could also be characterized by the nervous tic in the eyelid that came from attempting to keep one eye on the screen while keeping the other peeled for the supervisor. As the group became more proficient in gaming they began to grow weary of the limited types of activities offered by these early offerings and began experimenting with program codes and trying new ideas while at the same time becoming more proficient at elementary programming. Probably one of the earliest attempts at program alteration dealt with inserting code into the programs to allow a single stroke on the keyboard to return a program from a game mode to a normal job application. Those of you who went through the guilty conscience syndrome as I did will recognize the value of that little bit of programming wizardry. This was a form of self education and while it was a very elemental and unstructured activity, it was a very important first step in the formalizing of educational activities for users of the new machines.

Shortly after the mainframe game blitz, mircocomputers began showing up in the display rooms of companies specializing in electronic gear. Pitiful in capacity as they may seem to us now they were truly wondrous to behold at that time in history. In many instances they were nothing more than boxes with a series of toggle switches and red lights. No screens, no drives, no printers, no tape input, but they were the beginning of an era that even the most optimistic could not have predicted.

These elemental offerings were immediately devoured by a technologically starving band who immediately became a priesthood of sorts. They were the ones who spoke in the mystical jargon understood only by those who had been inducted into the secret mysteries of the initiates. The training was catch as catch can and the bulk of the members of this secret society tended to be people from engineering and other technically oriented backgrounds.

One of the strong points of American industrial development has always been our ability to provide ingenious solutions for problems that arise during the course of product development. It did not take long for the priesthood of computer devotees to begin to recognize areas in which microcomputers could be put to work doing routine kinds of activities. The earliest users began to band together to discuss applications for the new microcomputers. More importantly they began to write down HOW they were doing it. Once again we see an elemental form of computer education and literacy taking place. Most of the written information on microcomputer applications at this time was restricted to the technical journals read only by those in fairly restricted professions.

As the microcomputers went through their stages of development and more peripherals were added to make them more useful they became of interest to another group in the marketplace. We began to find an ever increasing number of people who gravitated to the new technological toys. As more and more people began to experiment with the new microcomputers new and ever increasing applications became apparent as people began to look at the device as a tool rather than a toy.

Our gamer group realized that they did not have to leave this element of interest at the office, but could continue their technological fantasies at home. Both gamers and technicians began to realize how these new technical marvels could apply in their own particular work situations to relieve a good bit of tedium. A tremendous number of people were forced to come to terms with bits, bytes, ram, rom, hertz, flippies, floppies and the other bits of techno-jargon if they were to become masters of their new machines.

The second happening was the blitz of printed media that emerged. Suddenly there were new books and magazines galore on the shelves of your favorite bookstore, each of which purported to make you an instant guru of the micro-world. An entire education subculture grew out of this spurt of the electronic wizardry we call microcomputers.

It is interesting to note here that as people became more comfortable with the new technology, the types of books and magazines that were available changed radically. The numerous publications that dealt with how to evaluate and purchase your first microcomputer gradually gave way to those who specialized in instruction in elementary programming. These too have waned and the surviving publications are those which in addition to including those items mentioned previously, have specialized more in the evaluation of available hardware, software, peripherals, and which have provided instruction in how to apply currently popular software packages. To open the pages of any of the currently popular computer oriented magazines today is to be bombarded with advertisements recommending software packages, and training courses all of which guarantee that you will become a very qualified user in the shortest possible time.

The earliest microcomputer users tended to be the middle and upper management types who were self educated and graduates of the school of necessity. Machines were brought into the office environment and were mastered by those persons with the most persistence. There were very few formalized classes that dealt with microcomputer applications. There were, for that matter, very few really good software packages available. This combination of facts lead to people banding together for self protection into "user groups". In this setting, those persons who understood programming language and structure assisted those who did not, and the result was that a certain semblance of order began to establish itself.

People who were trained on the mainframe applications began to see the tremendous potential of the microcomputer in the areas of management and decision making and began to write programs with wide general appeal. Suddenly microcomputers began appearing in offices as if by magic. Many of these were clandestinely brought into the office environment under the guise of being "calculators", or "dictating machines". The acceptance and proliferation of these microcomputers has escalated to the point that educational institutions and businesses are asking for some type of "formal" instruction programs for ever increasing numbers of persons who are being asked to become proficient on these machines.

Let us now look at the main problem at hand. Who are the new users of the microcomputers in our industrial and educational institutions, and how can they be trained in the most positive and efficient manner?

New Wave Users:

Because the microcomputer has become an accepted tool at most levels of management we are constantly exposing new groups of employees to its uses. More and more frequently the microcomputer is providing information formerly attained through the use of the typewriter and calculator. The implication here is that most new microcomputer system users will come from the employment group with the lowest levels of formal education. This group of new users is faced with not only the stress involved in adapting to a new employment position but also adjusting to a technology to which they may never have been exposed. This group will have the highest turnover in personnel, and have the least chance of succeeding if we do not provide a sound education program in the area of microcomputing.

One of the things which helped legitimize the microcomputer concept in business and education was entrance into the microcomputer marketplace by I.B.M.. This is not to say that the other product vendors were not completely reliable companies with excellent products, but only that the appearance of a microcomputer with the I.B.M. logo on it helped establish from a management standpoint the thought link that these machines must be thought of as legitimate tools capable of "real work".

The users of todays microcomputers have available to them a large number of existing software packages which fall into several easily identifiable categories. Of these categories, the three that are usually employed are word processing, spread sheets, and data base management. In order for any institution to provide a sound educational program for its microcomputer users it must first establish what products it is willing to support. Only after that decision has been made can the formal structure of the educational program be put into place.

Most newer software packages include a self paced tutorial program. These programs are generally directed at the highlights of the operational structure of the package but are lacking in the detail required to help people understand the inner workings of the package sufficiently. This prevents the users from adapting these packages to new and unique situations. Are these packages really of value from an educational standpoint? The answer is definitely yes, but only if the users have a firm understanding of the basic operating system of their microcomputers. Frequently the user gets caught up in the glossy commands of a pre-packaged program only to find that when trouble arises they lack a sufficient knowledge to be able to think problems through to a logical conclusion.

Unless caution is employed, managers tend to rely too heavily on these tutorials and purchased educational programs. The key to building a good educational structure is the creation of a well thought out program of instruction in the basic operating system of the machine. Only after the user has completed this basic instructional building block should an attempt be made to progress further. By providing an excellent marketing strategy as well as a solid product, certain programs became defacto standards in the three types of applications areas. The more frequently a product sold the more apt the vendor was to attract a third party selling an educational or tutorial program. Unfortunately some third party educational support programs were marginal and a detriment rather than an aid in understanding the product. This situation, in turn, caused many of the vendors of the more popular products to write their own tutorials.

Regardless of what software packages your organization intends to support, there will be within your organization an informal type of educational program . This is called "having a problem and taking it to someone who I know has this same software package to see if they can help me". While this situation is almost unavoidable you can take some steps to prevent it which will benefit your users. A formal program of education will provide a work atmosphere which will aid the persons who become proficient in the use of a software package or group of packages. They will be more productive when their time is not taken up in an informal instructional mode. The properly educated beginners will be capable of spending more time using system documentation to solve their applications problems.

Educating The Microcomputer Users:

The institution must be willing to establish some boundaries for the purchase of both hardware and software. It is an unrealistic expectation to believe that an educational program can cover all makes of machines and software products. Organizations may not wish to dictate to its managers the hardware and software configurations that they must purchase but should be willing to select those with the greatest chance of success in their particular operating environment and offer to support those to the fullest.

Just as there is no ideal software package, there seems to be no ideal location for the person or persons responsible for the education of the microcomputer software users. In many institutions the location of this function has defaulted to the computer center, while in others it has become a function of the personnel department or information center. The ingredient necessary to make this program functional regardless of its placement is the administrative commitment to its success.

Many business and educational institutions have in place an Information Center. This was the primary location where persons in these institutions came to acquire certain types of information, to use certain software packages not available to them due to cost or complexity or to use microcomputing facilities housed in a central location.

Since the creation of the information center concept originated, two things have occurred which have altered considerably its original intent.

The first was that there was a rapid reduction in the cost of hardware and software. It suddenly became possible to furnish an office with a full blown microcomputer with disk drives, monitor, and printer for a price that was formerly being paid for an electronic typewriter. Software packages with formerly prohibitive prices suddenly became available within the budget constraints of many operating units.

The second was that the management teams in many institutions began to change their thinking in relation to the "ownership" of information, and began treating it as a resource rather than the private property of the creating entity. Institutions established guidelines for the downloading, manipulating, and uploading of information on the mainframe.

Offices suddenly became "on-line" resources for all arms of the institution to rely on for input into their decision making process. For the first time many institutions began to see the decision making process as an integrated function which relied heavily on the individual offices as resources with the most up to date information obtainable.

Keeping the above two points in mind, it becomes a logical alteration of the information center to change its focus from one of assisting people by helping them to obtain and massage data to one of providing to the users instruction in the areas of commonly used hardware and software. The persons employed in these information centers are people with good technical backgrounds who are trained to work with persons with greatly diverse backgrounds. While this is certainly not the only location for the elusive educational function, it is one which merits exploring in many instances.

Regardless of where the administrative responsibility for the educational function resides, great care must be given to the establishment of reasonable goals for the persons being trained. Too frequently the higher administrative echelons tend to want to produce a group of highly trained specialists rather than to acquire from their training programs an excellent ground work which can lead to a high degree of self motivation and instruction.

One fact which most educational programs tend to overlook is that many of the persons with whom they will be dealing are quite frightened of the machine and their perceived inability to become its master. As the use of the microcomputer is pushed ever lower in the office hierarchy, the formal educational level of the user drops. As this level of education drops the less apt the users are to have been exposed to microcomputers.

To put a microcomputer into any office situation and expect the work production from the unit to pay for itself within a short period of time is impractical. To do this with no thought given to the training of the individual who will be using the equipment is even more unrealistic and yet institutions are placing their workers in this position with more and more frequency.

A realistic goal attainable by most institutions would be to provide a program by which a new user could become familiar enough with the operating system of their microcomputers to be able to handle most of the common problems encountered in the day to day operation of the unit. This basic instructional building block appears to be frequently overlooked. Many educational programs launch right into the instructional phases of the software packages with little or no mention of the operating environment in which the software package will be used.

The secondary goal would be to provide sufficient training in the use of a specific software programs to make the user comfortable enough with the products in question to feel free to experiment with new applications. The expertise gained through user experimentation and self initiative are more apt to be remembered.

Proficiency is a term which is used frequently in the attainment of educational goals. This proficiency goes hand in hand with the loss of fear which accompanies the acquisition of a good understanding of the basic elements of the software package. The users must feel confident in their ability to understand the basic operation of the package and to understand how to make use of the program documentation to its best advantage.

While I am stressing the self motivation and self confidence factors to be addressed in any educational endeavor I would not like to leave the impression that advanced classes are not desirable. The advanced classes need not be operated any differently than the beginning classes. The prime goal is to make the user comfortable enough with the most commonly used advanced commands to be able to think through any unusual situations with which they may be faced.

To summarize, the goals for any educational program should be as follows: 1. To provide for the user a level of self confidence and understanding of the basic operating system to be used which will foster a productive work atmosphere.

2. To provide the user with a sufficient understanding of the selected software packages to instill in the user the confidence to advance their understanding of the packages through their own self initiative.

While there are as many methods of teaching as there are teachers, it would seem appropriate to mention the four which are most likely to fit the institutional structures which are most common today. Regardless of the instructional mode chosen the key to the success of this, or any other type of instructional program will be the ability of the instructor to make the program interesting.

The first of these would be formal classroom instruction. Many institutions do not have laboratories established where hands on training can be obtained. In addition, many institutions do not schedule training sessions at times which are appropriate for the people in question. While the classroom situation is not the most desirable option most institutions can provide a facility which will suffice. There are a number of instructional aids such as the large screen and projection monitors which will assist in the creation and maintenance of interest. These are not replacements for individual work stations, but they are still tremendous improvements over what has been available in the past.

A second method of training involves the use of the tutorials that are available with the various software packages. These are designed to be self paced and can be checked out of a central library source and used as time allows. The most obvious problem with this method is that the student has no one with which to interact when questions arise. This leads to a high level of frustration and is another marginal use of time and facilities. Another problem involved with this method is that too frequently it ignores the students background or lack thereof in the basic fundamental knowledge of the operating systems being used.

The best use of classroom training is to combine it with laboratory activities. Placing this type of program in sequence with classroom activities and providing lectures as a background will allow the students to inspect the software packages from the common reference point obtained in the class. It also provides an opportunity for student interaction. The key element in this program is the utilization of a relatively short but comprehensive period of instruction in the basic skills necessary to handle the software package in question.

The third option would be to conduct the training in a laboratory situation where the lessons learned could be applied immediately. Having the inevitable problems occur in a controlled situation reduces the level of frustration considerably. As in all the options the key to success is the basic building block approach which allows the student to progress to a level where a reasonable degree of self instruction can take place.

The fourth approach to this problem is to farm out the educational program to a consultant, or to a local organization willing to provide the services. I have listed this option last because the institution has no direct control over the quality and type of instruction to be provided. If you are fortunate enough to be able to contract with a reputable organization who has the laboratory facilities already in place it may be a very viable option. This option is particularly attractive to smaller institutions or businesses where the numbers of dollars per person may not warrant the other types of options.

Cost is always a factor when discussing an educational program of this type. Regardless of whether you are being asked to justify space for classroom instruction, basic instructional materials, or a full blown laboratory situation, the answer will be the same. The institution must be willing to put a dollar value on what they expect to recover from such a program and react accordingly.

One easy way to make a quick estimation of whether or not the cost of an educational program is warranted would be to determine the number of microcomputers placed in service in the past year and estimate the average per hour salary of the persons who will be the primary users of these machines. Then multiply that per-hour figure times the weekly hours each machine will be in use. If your institution can afford to allow those dollars to be wasted or misused on a cumulative basis then probably no formal type of educational program is warranted. With the increasing amounts of time and funds being devoted to microcomputer applications, no institution can afford to be without some type of educational program.

Evaluation of the Educational Program:

Evaluation of the educational program by management can be conducted on both a formal and informal basis. The informal part consists mainly of verbal evaluations of the program and its success or lack thereof. It should emanate from the supervisors working in direct contact with the persons involved in the educational program. Specifically, these supervisors are in a position to determine whether the information presented in the seminars and classes is creating a feeling of confidence in the users. They would further be in a situation where they could observe the users in their every day work situations and should be able to tell whether specific sections of the training program need to be improved or altered. This informal evaluation is a very important input to be considered when updating or altering the content of microcomputer user education.

The program evaluation by the user should be broken into two parts. The first part being an evaluation of the session from the standpoint of whether the material was presented in a format which was understandable and to the point at hand. The second, which is most frequently overlooked, is the evaluation of the course after the trainees have had time to return to their normal work situations. It is only at this point that the determination of whether the course content was appropriate can be made. We frequently fail to utilize this very important follow up information when altering or evaluating the content of the courses to be taught.

The evaluation materials should be organized by the person responsible for the educational program and used as a basis for requesting new, or altered resources. Microcomputer technology is changing at a rapid pace and it is crucial that any educational program undertaken in this area be as up to date as possible.

To fail to provide an educational experience for the inevitable numbers of new microcomputer users each year is to do a disservice to the employing organization. Regardless of whether the we are speaking of an educational institution, business or industry the goals are the same and so are the penalties. Failure to provide this important educational function will create work flow bottlenecks which will most certainly outweigh the benefits obtained through the use of the newest technical advances.

MICROCOMPUTER SUPPORT AT THE UNIVERSITY OF ARIZONA

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MICROCOMPUTER SUPPORT AT THE UNIVERSITY OF ARIZONA

I. INTRODUCTION

A. Background

The University of Arizona, located in Tucson, is a land-grant state institution preparing to celebrate its first century in 1985. The school serves 31,000 students annually and employs approximately 12,000 faculty and staff. The University has both a medical center and law college and is a "Research 1" school indicating its commitment to research as well as teaching.

B. Motivation for Action

In the last quarter of 1983, the University saw that purchasing activity for microcomputers and related products was increasing rapidly, but without direction. Purchase decisions were made by departments and individuals independently. Purchases were made by unsophisticated users, often with inadequate attention to issues of future expansion, availability of appropriate software, and availability of service and training. In addition, a large variety of brands were purchased from a multitude of vendors. Often, these systems could not exchange data, and communications were limited.

It became apparent that concerted effort could produce three immediate benefits:

- Considerable cost savings, through volume discounts, might be possible if purchases were limited to a few vendors.

- Compatible systems between campus users would allow for communication between systems, exchange of information between users and assure the availability of "back up" equipment.

- The entire campus could benefit from the knowledge of microcomputer "experts".

The task that faced the University was seen as selection of microcomputer equipment that:

- satisfied the diverse needs of academic and administrative departments;

- met cost and compatibility objectives;

- would allow unsophisticated purchasers easy access to a complete line of hardware, peripherals, software and service.

MICROCOMPUTER SUPPORT AT THE UNIVERSITY OF ARIZONA

II. SELECTION

A. Selection Committee

A committee was formed of high level administrators of several areas on campus with interest in computers. These included:

Academic Areas
  Management Information Systems
  College of Engineering
  Computer Sciences
  Office of Medical Education

Administrative Areas
  Administrative Services
  University Computer Center

The committee met to survey the existing systems and users on campus, and to establish guidelines for future purchases. The committee never intended to select a single vendor or type of equipment for University purchase. Rather, the committee wished to select equipment for a "recommended" or "supported" list. Purchasers would be free to select from among those items, on the basis of their unique needs, or even to purchase items not on the list - at the risk of incompatibility with campus systems and without the benefit of negotiated discounts.

B. Request for Quotation

A Request for Quotation (RFQ) was prepared for suppliers of microcomputers and related products. Features of interest in the RFQ were:

- Vendors were asked to supply information and prices for a variety of system hardware including: the basic computer, expansion products, and peripheral equipment.
- Vendors were asked to provide information and prices on available software.
- Vendors were asked to provide information on both warranty and out of warranty service.
- Vendors were asked to quote hardware and software discounts for both University departments and individuals (faculty, staff, students).

The purpose of structuring the RFQ in this way was to determine which suppliers would offer the most complete systems at the lowest net price to the University.

More than 140 manufacturers and suppliers were sent the RFQ, and nearly 50 responded. Twenty-four useful bids were received, and evaluated by the University.

C. Evaluation

Three separate groups evaluated the bid responses independenty. They were personnel from:

University Computer Center
Management Information Systems
Business Information Systems (representing Administrative Services)

Each group independently prepared a report for the Selection Committee using the bid information, articles in the literature, and other data. In most cases, suppliers made hardware and software available for testing by the groups.

The BIS evaluation took this form: each response was summarized in two parts, a brief data sheet (Figure 1), and a 10-point rating according to criteria established by the committee (Figure 2).

D. Selected Products

The committee selected products that:

- Used MS-DOS (or proprietary versions of MS-DOS) operating systems, for a wide offering of software;
- Offered local service and training support;
- Offered both departmental and individual discounts;
- Were "full line" products insofar as expansion and peripherals.

The products selected were:

Desk-Top Units
Digital Equipment Corp. (DEC) Rainbow 100 & 100+
IBM-PC/XT
NCR-Decision Mate V
Zenith - Z 110/120

Portable Units
Compaq
Kaypro 4 & 10 (hard disk)
Otrona-Attache

III. PLANS TO SUPPORT MICROCOMPUTER BUYERS

The committee originally formulated a three-part plan to support departments and individuals who were interested in microcomputer purchases. This included pre-purchase support, purchase advice and assistance, and after-purchase training.

An important element in this plan was the establishment of a University-sponsored facility that would act as a focus for microcomputing. The Microcomputer Resource Center (MRC) was established by the Department of Business Information Systems (a division of Administrative Services), and funded by the Vice President of Administrative Services. The primary mission of the MRC was to familiarize purchasers with the selected products and to assist academic and administrative departments, and University personnel in selecting appropriate hardware and software.

A. MRC - Charter

The MRC, as implemented by BIS, was to provide pre-purchase support for buyers by acting as:

- a source of general information on microcomputing, microcomputer applications, and the selections of the committee,
- a "showroom" for the selected models of equipment without interference of pressure from sales personnel,
- a source of general advice on the system configuration and types of software required to meet the individual's needs,
- a contact with suppliers to research unusual equipment or software questions,
- an opportunity to "test drive" each computer and available software before purchase,
- a source of prices for systems with comparable features and performance.

The MRC was to render purchase assistance by:

- providing assistance to buyers to analyze their needs, to compare specific products and to configure useful systems,
- providing correct catalog or part numbers to order the appropriate system configuration,
- providing service and training information,
- verifying eligibility of individual purchasers for University discounts.

As will be shown in later sections, these general objectives were satisfied in a variety of ways, based on the adaptive response of the MRC staff to the demands placed on it.

B. MRC - Implementation

The MRC was installed in a "temporary" University building; a property acquired by the University for eventual demolition but useable as space until that time. It was located midway between the Main Campus, and the University's Health Sciences Center. Student/staff/visitor parking was located nearby.

The MRC unit was about 1,000 square feet, and divided into three rooms. Extensive modification was required to provide adequate lighting, electricity and security for the facility. This expense was paid for by Administrative Services.

Staffing consisted of one full-time manager (a BIS Management Analyst), three FTE graduate students (from computer-related areas), and a part-time student clerical worker. The MRC is open continuously from 9 to 4, and the hours of the staff are staggered to provide continuous coverage.

C. MRC - Vendor Support

The MRC could not exist or function in the way it has without a very high degree of vendor support and assistance. This commitment began right from the start.

As the MRC building was being remodeled, the University held a 3-day "computer fair" in a room in the Student Union. The seven selected vendors were invited to bring their microcomputers, related products and software to the "fair", and to provide personnel for demonstrations.

The "fair" gave the University the opportunity to:

- stimulate interest in microcomputers on the campus in general,

- advertise the MRC opening; one week later,

- have the vendors train the MRC staff on their machines. .

In earlier contacts, the University had asked the vendors to provide "demonstrator" equipment: computers, monitors, printers, etc. The "computer fair" also gave the suppliers the opportunity to simply leave their demonstration systems at the University for use at the MRC. All did.

In general, the vendors provided:

- complete demonstration hardware - a microcomputer, monitor and printer (some with hard disk, some with color graphics);
- demonstration software - operating systems, demo disks of popular software, and documentation;
- product literature;
- price lists.

Some of the more cooperative suppliers went beyond this. They provided glossy brochures, technical literature, reference books, and directories listing third party software. Some vendors also supplied toll-free numbers and the names of factory-trained representatives that could be used to research unusual questions, or supply additional information. A few vendors provided extended training to the MRC staff, on both hardware and software, using their own training personnel.

D. Other Planned Support

The selection committee had planned to establish other mechanisms in support of microcomputers on campus. These included finding microcomputer and application "experts" who could act as campus references, establishing a user-information exchange, and conducting the product review and selection process periodically.

IV. PERFORMANCE

The MRC quickly became the focus for microcomputers on the UA campus. Its role eventually encompassed the original scope for its operation, and much more.

A. Level of Interest

Beginning with the "computer fair", more than 1,500 visitors were exposed to the fact that seven machines had been selected for broad-based campus support. Following the opening of the MRC in March of 1984, and through the end of October, more than 1,800 additional visitors have come to the MRC. Some statistics on these visits are shown in Table 1.

The statistics show that the number of MRC visits on a weekly basis are quite variable, ranging from 30-100 visitors. Weekly average is about 50 visitors. Responses show that visitors are equally divided among persons shopping as individuals, for departments and for "both" individual and departmental use.

There appeared to be no significant difference in traffic between "in school" periods VS summer session. In fact, the only significant difference in MRC visits seemed to be associated with "special offers".

B. Special Offers

Dissemination of information regarding special offers, price and product changes became one of the most important MRC functions. Two examples of special offers through the MRC were:

- the UA matching funds subsidy program,
- a vendor "double discount" offer.

During the period that these two offers were in effect, MRC traffic increased to an average of nearly 80 visitors per week, and ranged from 60-100 people. (Table 1)

The MRC played a crucial role in publicizing these two special offers (and in providing other information regarding microcomputer products and prices) to the campus as a whole. The general role of the MRC was to:

- obtain the full facts,
- disseminate information (campus mail to departmental level),

- act as source of facts for follow-up by interested parties,
- offer advice as to how the special offer could be used on a case-by-case basis.

The first special offer was by the University itself. UA offered to match funds spent by departments purchasing basic computer systems. This program was intended to put the power of computing and office automation in the hands of the "have nots" on campus; those departments who in the past have not had sufficient motivation or funds to buy computers.

The MRC provided a broad program announcement, and acted as a resource for prospective buyers. They offered basic product information and prices, of course. Beyond that, they helped unsophisticated buyers to:

- analyze their needs; word processing, departmental data base, budgeting and financial records;
- help buyers compare software packages on the basis of cost, performance and ease of use;
- configure systems that met the buyers hardware and software needs;
- ensure that purchase orders were complete and correct.

During the subsidy period, MRC visits ranged from 60-85 visitors per week. Departments (and "both") made up almost one half of those visitors. It was also found that the MRC became the focus of an equal or greater number of telephone inquiries in this period.

The second special offer was through one of the University's vendors. DEC made a special discount available to University departments, on its Rainbow product line. DEC offered a limited-time increase in its discount from 35% to 65% off the list price, or nearly a double discount.

Again, the MRC - under BIS leadership - took responsibility for publicizing the offer to the campus as a whole. The MRC collected the facts from the supplier to determine which products were offered at the discount, to provide sample configurations and prices, and to make sure all parties (e.g., administration and purchasing) were prepared to process orders within the time limit.

Again, the MRC provided free consultation and analysis of user needs, configured hardware/software systems, and assisted users to specify complete and useful systems.

Visitors came to the MRC at a rate of 75-95 per week during the DEC offer; 60-70% of them represented departments. The University purchased systems with a retail value of $1.6 million through this offer, and paid $600 thousand.

C. The Typical Visit

Aside from the special offers, we would like to present some observations on our typical visits and visitors to the MRC:

- almost none are typical;
- length of visit may be from 15 minutes to 2 hours; a more usual range is 30-60 minutes;
- 1 1/2 to 2 times as many telephone calls are received as visits are made;
- interest is high in word processing applications with significant interest in scientific and foreign language applications, and in mailing list management;
- interest is also high in business graphics, architectural and other high quality graphics;
- data base, spreadsheets, and programming languages are of moderate interest;
- significant interest was found in direct data capture and instrumental applications;
- about one-third of the visitors to the MRC (since mid-August) were return or repeat visitors;
- interest in printers, modems, and other peripherals was as high as the interest in microcomputers themselves;
- visitors used the MRC for informal software training, consultation, and "test drives" as often as they used it as purely a showroom for hardware.

D. Performance Against Objectives

The MRC has performed very well with regard to its original objectives. It has also been asked to fulfill the needs of the campus community in supplementary areas. The MRC's performance is summarized below:

Primary Objectives	Met
- General information on basic systems	Yes
- "Showroom" and "test drive" functions	Yes
- Configuration advice for basic systems	Yes
- Price information	Yes
- Research special needs	Yes
Supplemental Activities	
- Publicity of special offers	Yes
- Information on advanced or special purpose hardware/systems	No
- Programming services	No
- Informal training and "coaching"	Yes
- Classroom or laboratory training	No

Some of the latter items are discussed in a later section.

E. Cost of Operating the MRC

An estimate of the annual MRC operating budget is presented in Table 3. This annual expenditure of $78,000 does not include any space rental charges, or the initial MRC set-up costs.

- $78,000 represents an expense of about $25 per visitor (or $10 per visitor plus phone caller) served by the MRC.
- $78,000 represents just over 5% of the savings on the DEC offer alone.
- $78,000 represents only 2% of the retail value of estimated microcomputer purchases on campus this year.

V. SURPRISE!

The MRC has provided as many unanticipated results as it has provided expected benefits. We feel that presenting these surprises will also be of value.

A. Dynamic Marketplace

The microcomputer market has proved to be even more dynamic than we had planned for. The MRC has had to respond quickly to price changes, product configuration changes, and changes in vendor participation.

Price changes have come from manufacturers monthly, sometimes weekly. Even stable suppliers, like IBM, have modified price structures over the past 8 months. The MRC has publicized major price changes and continually prepared revised price/configuration sheets for use by visitors, and this activity requires considerable resources.

The past 8-month period has also seen considerable modification to hardware configurations; for example; IBM upgraded RAM offered as standard in the PC; Kaypro upgraded disk drives offered. The MRC has had to keep current on these changes and their impact on system configurations that they propose to visitors. This has generally meant additional training by vendors, and demand for literature.

Reconfiguration and product modification introduction has created additional problems in terms of institutional policy. The microcomputer selection process involved the State of Arizona bidding procedure. Each product modification required that the University decide whether the modified product was, in fact, covered by the original bid. The most useful situations were those in which a supplier had responded to the RFQ using the terms of an existing volume discount agreement with the University. This "product line" bid was found to be less restrictive than other bids.

Another aspect of the dynamic marketplace has been the changing nature of the participation of the successful bidders. In one case, a selected vendor offered a contract and computer models they offered after award of the bid that were significantly different than those proposed in their bid response. Another supplier went from a cool attitude toward the MRC to enthusiastic support, when local sales responsibility was changed. Finally, one manufacturer - Otrona - went out of business during the 8-months the MRC has been open.

MICROCOMPUTER SUPPORT AT THE UNIVERSITY OF ARIZONA

B. Information Center

The MRC has become the focal point for microcomputer information on campus in many respects. We mentioned earlier the MRC's role in disseminating:

- price and product information on the selected microcomputers, and
- information regarding special offers.

In addition, the MRC provides a great deal of information regarding:

- software performance specifications and comparisons of competing products;
- special interest software (e.g., statistical packages);
- special interest hardware (e.g., Analog to Digital converters);
- performance of non-selected computers (for comparison shoppers);
- specifications of printers and other peripherals, and compatibility with selected computers.

C. Stimulating Free-Trade

One last surprizing benefit is that local vendors have aggressively sought business with the University, especially with individuals. They have done this by meeting the cost-performance of selected products using:

- discounts for University staff and students,
- non-selected computers,
- bundling of software and peripherals,
- rapid delivery from inventory,
- use of third party parts (boards, monitors, etc.) to lower costs.

The availability of supplier discounts and complete information has, in short, made better deals available to the campus community by stimulating competition between suppliers.

D. Unsatisfied Needs

The MRC experience has also revealed some basic campus needs that remain unsatisfied, due to the limitations of the program. These include:

- formal training in the use of application software packages;
- programming services related to data base and spreadsheet applications for inexperienced users;
- installation, testing and service for microcomputer systems;
- availability of information on a broader range of software, and peripherals;
- addressing the needs of sophisticated microcomputer users on campus.

The MRC, it seems, cannot - in its present form - be all things to all potential users. There is insufficient space and equipment to perform classroom or laboratory training. Such training would require additional University support to purchase machines, add staff and provide physical facilities. This decision was felt to be a separate issue from the MRC, to be addressed by the Continuing Education Division, outside vendors, and other units of the University.

The MRC staff has not been allowed to install systems, program them or consult on University applications as part of the MRC. This area is one where considerable benefit to the institution is possible, but one which is outside the basic MRC mission. The MRC will not engage in this activity without a change in policy and increased staffing.

Finally, until the University standardizes on software and peripherals, the best that the MRC can do is provide general guidance. The selection committee seems to have no intent of establishing those standards, and so the MRC will continue as it has in these areas.

FIGURE 1

SUMMARY OF RESPONSE
TO MICROCOMPUTER RFP

VENDOR: NCR

PRODUCT: Decision Mate V

CPU(s)/MHz(s): Z-80A (4 MHz)
8088 (5 MHz)

OPERATING SYSTEM(s): CP/M-80
CP/M-86
MS-DOS

STANDARD ROM/RAM: 64k

MAXIMUM RAM: 512k

DISCOUNT % 45% to University as re-seller or, for direct sales:
DEPARTMENT: 40% (direct)
FACULTY/STAFF/STUDENT: 40% (direct)

TYPICAL SYSTEM PRICE (RETAIL): 8-bit system $1590 ($2658) 8/16 bit system $1854 ($3090) 8/16 with Winchester $3084 ($5140) Printer $498 ($830)

COMMENTS: Presence of large amount of donated equipment on campus, and NCR's representation as part of that, present unmatched levels of service to the campus community. User groups, training, technical assistance, and ability to "test drive" equipment are facilitated by this arrangement.

PRODUCT: NCR - Decision Mate V

CRITERIA USED IN RATING RESPONSES TO MICROCOMPUTER RFP'S

1. SOFTWARE AVAILABILITY (range & variety; applications; support for programming languages):

   RATING: Fair - Complete offering of application packages, but selection narrow; few programming languages. Will improve since NCR uses CP/M, MS-DOS.

2. MANUFACTURER'S REPUTATION (financial strength; technical assistance; technical documentation):

   RATING: Good (+) - Recent agreements to provide equipment and training on campus to assure highest level of access to manufacturer.

3. SUPPORT SERVICES (quality & availability of services; maintenance & repair services, locally available; training for all purchaser types; delivery time):

   RATING: Good - Local representation/service best of all responses.

4. COMPATIBILITY (installed base generally, and at UA; intercommunication, networking ability; hardware/software available for link to larger systems; widely used CPU operating system):

   RATING: Good - With NCR base; communication software offered; LAN offered. CP/M, MS-DOS are OS for Z-80, 8088 processors.

5. EASE OF USE (equipment design; easily understood documentation):

   RATING: Not rated. (Need product/documentation to evaluate.)

6. AVAILABILITY OF PERIPHERAL HARDWARE:

   RATING: Good - Accessability to manufacturer on campus assures that we will see, and test all types available.

7. EXPANDABILITY (RAM, virtual memory, etc.; storage media; addition of functions; bit-mapped graphics; co-processors):

   RATING: Good - Plug-in expansion of RAM; add-on hard disk among offerings.

8. INITIAL COST (list/discount pricing on various configurations):

   RATING: Good - Discounted prices are among the lowest in all the responses.

9. COMPLETENESS OF OFFERING (sufficient hardware offered to build complete system; bundled software; several types of software available at discount; level of support for purchasers):

   RATING: Good - Quite complete. No software bundled, but all offered at 65% discount.

10. EASE OF ADMINISTRATION (ease of ordering; ease of pricing; consistent with other bids):

    RATING: Fair - Need more information on procedure for ordering. Will sell directly to individuals.

TABLE 1

TOTAL VISITORS FROM 3/5/84 TO 10/31/84

WEEK OF	# VISITORS	# INDIVID.	%	DEPT'S	%	BOTH	%
3/9	98					98	
3/16	62	35	56.5%	18	29.0%	9	14.5%
3/23	64	31	48.4%	29	45.3%	4	6.3%
3/30	84	36	42.9%	35	41.7%	13	15.5%
4/6	80	41	51.3%	37	46.3%	2	2.5%
4/13	59	25	42.4%	28	47.5%	6	10.2%
4/20	45	30	66.7%	7	15.6%	8	17.8%
4/27	41	36	87.8%	1	2.4%	4	9.8%
5/4	55	32	58.2%	17	30.9%	6	10.9%
5/11	53	38	71.7%	13	24.5%	2	3.8%
5/18	73	55	75.3%	15	20.5%	3	4.1%
5/25	73	38	52.1%	23	31.5%	12	16.4%
6/1	82	24	29.3%	51	62.2%	7	8.5%
6/8	93	22	23.7%	43	46.2%	28	30.1%
6/15	41	13	31.7%	16	39.0%	12	29.3%
6/22	34	22	64.7%	2	5.9%	10	29.4%
6/29	55	24	43.6%	13	23.6%	18	32.7%
7/6	43	15	34.9%	18	41.9%	10	23.3%
7/13	40	26	65.0%	8	20.0%	6	15.0%
7/20	47	15	31.9%	15	31.9%	17	36.2%
7/27	51	6	11.8%	12	23.5%	33	64.7%
8/3	37	11	29.7%	11	29.7%	15	40.5%
8/10	50	9	18.0%	26	52.0%	15	30.0%
8/17	36	11	30.6%	18	50.0%	7	19.4%
8/24	62	20	32.3%	20	32.3%	22	35.5%
8/31	58	9	15.5%	18	31.0%	31	53.4
9/7	37	2	5.4%	9	24.3%	26	70.3%
9/14	36	5	13.9%	7	19.4%	24	66.7%
9/21	57	7	12.0%	14	25.5%	36	63.0%
9/28	45	10	22.0%	10	22.0%	25	56.0%
10/5	37	7	19.0%	9	24.0%	21	57.0%
10/12	40	12	30.0%	9	23.0%	19	48.0%
10/19	41	10	24.0%	15	37.0%	16	39.0%
10/26	37	3	8.0%	15	41.0%	19	51.0%
10/31	22	4	18.0%	6	27.0%	12	55.0%
TOTAL	1846	680		582		584	
PERCENT		36.8%		31.5%		31.6%	
AVERAGE	52.0	18.6		18.3		17.5	
MAXIMUM	98	55		51		98	
MINIMUM	34	2		1		2	

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TABLE 2

VISITORS DURING SPECIAL OFFERS

3/23/84 TO 4/13/84 MATCHING FUNDS OFFER

5/25/84 TO 6/08/84 DIGITAL EQUIPMENT CORPORATION OFFER

WEEK OF	# VISITORS	# INDIVID.	%	DEPT'S	%	BOTH	%
3/23	64	31	48.4%	29	45.3%	4	6.3%
3/30	84	36	42.9%	35	41.7%	13	15.5%
4/6	80	41	51.3%	37	46.3%	2	2.5%
4/13	59	25	42.4%	28	47.5%	6	10.2%
5/25	73	38	52.1%	23	31.5%	12	16.4%
6/1	82	24	29.3%	51	62.2%	7	8.5%
6/8	93	22	23.7%	43	46.2%	28	30.1%
TOTAL	535	217		246		72	
PERCENT		40.5%		45.9%		13.6%	
AVERAGE	76	31		35		10	
MAXIMUM	93	41		51		28	
MINIMUM	59	22		23		2	

TABLE 3

BUDGET FOR THE MICROCOMPUTER RESOURCE CENTER
ESTIMATED ONE-YEAR

CATEGORY	ITEM COST	TOTAL COST
A. PERSONNEL:		
Manager	$24,000	
Graduate Assistants	32,000	
Clerical Support	4,000	
ERE	6,000	
Total	66,000	$66,000
B. PUBLICITY		$400
C. TRAINING TOOLS:		
Graphics Products	$1,500	
Materials	500	
Software	2,000	
Total	4,000	$4,000
D. OPERATING SUPPLIES		$3,000
E. UTILITIES:		
Telephone	$1,300	
Electricity	1,300	
Heating	200	
Total	2,800	$2,800
F. CAPITAL ITEMS	-	$1,800
TOTAL		$78,000

PERSONAL COMPUTER SUPPORT IN HIGHER EDUCATION: A PANEL DISCUSSION

Wayne Donald
Assistant Vice President
Computing & Information
Systems
Virginia Tech

James Morgan
Director
Information Resource Management
State University System
of Florida

Lynda Sloan
Assistant Director
Computer Center
Iona College
New York

Martin Solomon
Director
Academic Computing
Ohio State University

During the past several years personal computers (PCs) have been introduced at most institutions of higher education. Some institutions are requiring students to purchase their own PCs, others are providing public labs to meet the academic demand, others are enhancing administrative information systems by using the PC as a management tool, and others are simply finding many students arriving with a PC, much as they did with calculators a few years ago.

Whatever is the case, the institution needs to support the PC and its user base. This discussion offers a description of how PCs are supported at three institutions and in one statewide system.

The proceedings document has been prepared in outline form to give an indication of discussions by panel members. If more information is desired, panel members may be contacted at addresses listed in the CAUSE directory.

MARTIN SOLOMON - OHIO STATE

Issues
When is it effective to provide centralized support?
Are there different categories or levels of support?

Types of Support
Intellectual
Financial
Communications
Service/Maintenance

Intellectual
Provide:
- selection assistance
- product information
- initial training
- access for demonstration
- access for evaluation

Promote, facilitate Users Groups

Financial
Negotiate (volume) discounts
Negotiate site licenses
Negotiate agreements for discounts
Subsidize or facilitate personal purchases by faculty, staff, or students (e.g., no-interest loans)
Maintain libraries of public-domain libraries (in some cases through Users Groups)

Communications
Facilitate terminal emulation
Facilitate file upload/download
Facilitate data communications
Provide free communications software

Service
Negotiate volume/discount service agreements
If cost-effective, provide on-campus equipment service

LYNDA SLOAN - IONA COLLEGE

Background Information
Comprehensive liberal arts college
6500 students
Computing degree programs with 800 undergraduate majors and 500 graduate majors
Committment to Science and Technology literacy; Computing Literacy requirement; Science and Technology Literacy requirement

Philosophy on Computing

Computing an integral part of education, integrated across the curriculum
Computing as a utility

Profile of Personal Usage of Computing

400+ administrators, faculty and staff personally using computing
6000+ students personally using computing
200+ college courses

Computing Equipment

Mainframes: IBM 4381; IBM 4341; 200+ terminals
Minicomputers: IBM Series/1
Microcomputers: 300 IBM PCs (PC, XT, AT, Jr systems); 75 Apples, Commodores, Tektronix, etc.

Effect of Computing Literacy Policy Upon Computing

Demand for more hardware, software, user services
Increasing shift to microcomputers by new users
- From 1983 to 1984, 50% increase in number of microcomputers

Emphasis upon use of general purpose software tools (word processing, spreadsheets, data base systems, data analysis systems)
A new user profile: new to technology; less sophisticated; varying degrees of computer-phobia; very dependent upon user services; need extensive range of services

The Computing Center and Microcomputer Support Services

Hardware support
Software support
Communications support
User services
Computing Center purchasing power
Computing supplies

Availability of Microcomputers

7 Computing Center managed "public" facilities; 3 departmental facilities; administrative and departmental offices; personally owned systems; loaner systems; rentals
Policy on personal acquisitions of microcomputers; voluntary; discounted; subsidized for faculty and administration
Institutional systems: IBM PC/PC-compatible systems; Apples

Support of Microcomputer Hardware

Selection of hardware
Installation of hardware
Maintenance of hardware
- Trained microcomputer technicians on staff

- Internally maintain hardware
- Support with external maintenance as needed

Loaner systems
Support of expensive peripherals (letter quality printers, plotters, etc.)
Computer supplies; paper; ribbons; diskettes; labels; etc.

Support of Microcomputer Software
Support of wide range of general purpose application tools
Selection of software
Installation of software
Loaner systems

Support of Data Communications
Support of terminal emulation to mainframe systems
- Institutional systems have communications support as a standard feature

Support of central communications hardware and software to support use of microcomputers as mainframe terminals
Help users access external data bases and information services
Selection of modems
Installation of communications hardware and software
Loaner systems

User Services
Education: seminars; computer-based training
Demonstration of hardware and software
Consulting services for faculty, administrators, students
User friendly documentation: technical bulletins; user guides
Reference library: periodicals; reference services; hardware and software reference manuals; etc.
Contract services for systems and programming support (limited)
Helping users on upgrade hardware and software
Provide 1-1 support where resources are available

JAMES MORGAN - STATE SYSTEM OF FLORIDA

Unique problems dealing with a State-wide system

Microcomputer Support Centers

General Usage in the System

Future Plans

WAYNE DONALD - VIRGINIA TECH

Virginia Tech

- Public institution
- 22,000 to 23,000 students
- Combined computing facilities
- Required PCs in Engineering

PC Usage on Campus

- IBM PC required for Engineering freshmen (1200)
- Additional 1000 PCs on campus
- Under consideration: Computer Science; Business

Two PC Programs

- College of Engineering
- All others

PC Management Issues

- Establishment of PC Auxiliary
  - Administration
  - Receiving
  - Distribution
  - Warranty and Maintenance
  - Extraordinary Issues

PC Support Issues

- Consultation
  - Engineering "HOTLINE"
  - Computing Center
- State procurements to support PC program
- Education (primarily faculty)
- Hardware and software evaluations
- Hardware and software negotiations
- Hardware and software support from computing resources
- Coordination with PC Auxiliary
- Establish a demonstration facility

Special Issues

- State restrictions (in purchasing)
- Financing for students and faculty
- Warranty and maintenance service

IS AN INTEGRATED WHOLE REALLY GREATER THAN THE SUM OF THE PARTS?

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ABSTRACT

The marketplace believes that integrated software is basic to increasing productivity of information management. However, there is little experimental evidence whether the ease of use and functionality of these packages is greater than competitive separate components. This paper compares LOTUS 1-2-3 with three separate packages making up the same functionality. The functions of the SuperComp 20 (SC20) spreadsheet, the NPL information management system and the MAPS PRO graphics system all running on a DEC PRO 350 microcomputer are compared with the LOTUS system on an IBM PC compatible. This comparison is done along the three dimensions of decision support system generators: dialog, data, and use of models.

The common tasks investigated are decision support using a student information database and financial record keeping for rental property. Results suggest that an integrated package is easier to use and more functional at least compared to these particular separate packages. The only exception to this was the cumbersome steps LOTUS required in handling spreadsheet entries as a database. It was also the case that with this exception, the individual spreadsheet and graphing functions of LOTUS were each individually superior to the specific standalone packages considered. Thus it emerged that not only was integration a valuable characteristic of the LOTUS system, but also that individual components could be considered separately — and often were by actual users.

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IS AN INTEGRATED WHOLE REALLY GREATER THAN THE SUM OF THE PARTS?

Software Packages Compared

In an attempt to assess the role of integration in micro software, the capabilities of the LOTUS 1-2-3 integrated software package to handle spreadsheets, graphs and data were compared with those of three separate or independent packages each designed to excel at just one function. The SuperComp 20 (SC20) spreadsheet from Access Technology, Inc. was used to compare spreadsheet functions. The MAPS PRO Graphics package (MAPS) from Ross Systems, Inc. was employed for graphing data, and the nonprocedural language, NPL, from Desktop Software Corp. was used in storing and organizing data abilities. In the discussion which follows the reader is assumed to have at least a rudimentary familiarity with each type of package. Further, the reader will benefit the most if he or she has used LOTUS 1-2-3.

Relationship Between Independent Packages

In examining the capabilities of the three independent packages, all possible links among the packages were considered. These relationships are illustrated in Figure 1. It seems obvious, however, that not all paths are equally valuable to typical business applications. For example, there is little likelihood that graphed data would need to be transferred to either a database or a spreadsheet -- whereas the reverse links (A, B) are quite likely. Further, retrieval from a database for display in a spreadsheet (C) would likely be more useful than storing specific spreadsheets (D). Spreadsheets usually capture and manipulate parts of a database rather than formatting extensive numerical data which would need to be stored in a database. Also, given the file and record structure of a database with many fields containing alphanumeric data, such data would seldom need to be manipulated in a spreadsheet. Queries and sorting of this data would likely meet most user needs.

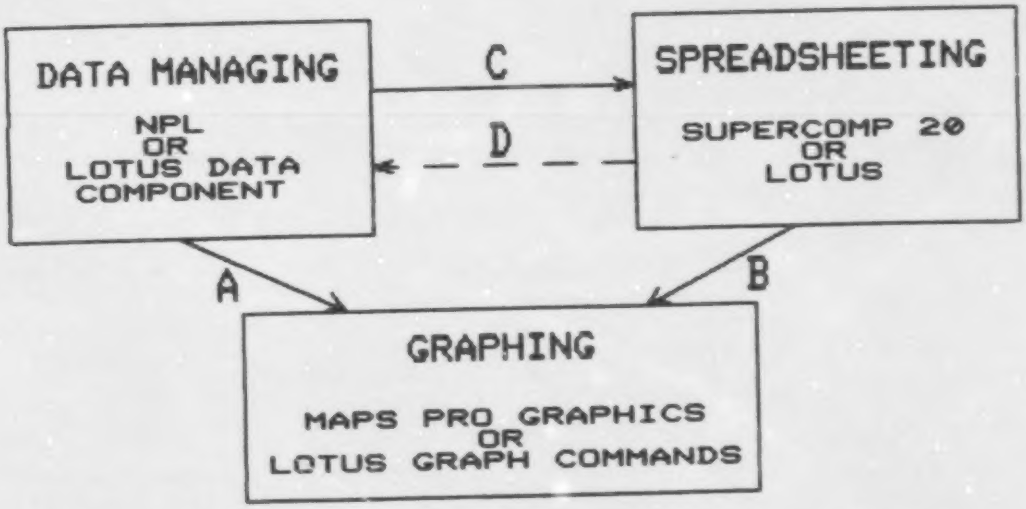

FIGURE 1: Data Transfer Between Functional Capabilities of Software Packages

With applications outside business, however, other links back from graphed data might occur. For instance, it might be useful to store a point-by-point representation of a graph back in a database if one wished to archive such a graph or store such a design as might be the case with computer-aided design. Also a spreadsheet rather than a database might be used by a statistician who might wish to move points on a graph back to a such a form for possible curve fitting.

Applications Used With the Packages

Two applications were implemented with this software. First, data on 354 MBA students was stored using NPL and LOTUS. This included both student demographic information and data on courses taken. Second, the financial records dealing with the management and financing of three rental properties, covering 9 fiscal years of operation of these properties, was loaded into the SC20 and LOTUS spreadsheets.

Tasks Attempted

Given these applications, the following tasks, which illustrate links A, B and C in Figure 1, were attempted with the environment of the independent packages and with the integrated environment of LOTUS 1-2-3.

Graphing Output from a Database. Our task here was to graph course grade point averages (GPA's) as a function of year taken with plots for each sex. All data was available in the database created first within NPL, and although numerous procedural steps were involved, it was not difficult to extract specific course averages over years and sex. What proved to be a significant weaknesses of MAPS was its inability to take and graph both X and Y points from a data file. The vertical Y values could be read from a file, but the horizontal X values had to follow a predetermined progression, such as days, months or fiscal years, without allowing for gaps in years or points not being sorted by a specific uniform interval. Thus, the test graph could not be produced by the MAPS software.

When the data for this test was loaded into LOTUS, perhaps the biggest annoyance was finding a convenient part of the spreadsheet in which to do the calculations. A LOTUS spreadsheet is not structured automatically as a modular procedural language program would be. Further, in choosing such a work space — typically at the bottom or left of the spreadsheet — one has to plan for other similar, though yet unidentified, tasks which might need to be done in the future. The suggestion by Tetlow (1984) to structure a spreadsheet a screen-at-a-time with a single screen serving as a table of contents may easily solve this problem, however.

Once a portion of the bottom of the spreadsheet was found, it was easy to select the year taken and sex data for courses. The averaging formulas were easy to write though there was some confusion in locating the selection criteria as these had to be in successive rows not columns (which required a "deeper" work area). Because each criteria range (for which years to choose) required two rows, ranges could not be copied after the first one was built to select a given year, but they needed to be entered manually for all years. Entering the years themselves was quite easy with the LOTUS "fill" function which generated a series of numbers automatically. This is analogous to what MAPS can do, but LOTUS has the flexibility that years could be omitted if corresponding data are not present.

Once one selection formula and its selection criteria were built they were copied for selection of comparable data from another course. The only hitch in this was that the criteria ranges did not adjust their relative addressing completely (as the range required at least two rows; one for the heading, and one for the condition). This required manual adjustment in the copied formulas and criteria.

Plotting from the resulting numbers was straightforward with only slight difficulties selecting the right options to get the correct format. The range of formats and styles was comparable to MAPS though LOTUS did allow "twisting" the graph to fill a full page while MAPS was restricted to the normal orientation on half a page.

Graphing Data from a Spreadsheet. This proved quite easy in the independent environment since the MAPS Users Guide explained how to do it with SC20 — although the SC20 package is from a different vendor. Also in this test the SC20 spreadsheet contained budget data which directly lended itself to the fixed horizontal (in this example, yearly) divisions built into MAPS. Two steps were involved which were somewhat time consuming but not overly complicated. First, line numbers had to be added to the data from the SC20 spreadsheet. This was done in SC20 itself by inserting an extra column in the spreadsheet and building in a simple formula to insert line numbers. Second, it was necessary to engage in a rather lengthy question and answer procedure in MAPS to specify 1) the characteristics of the graph that were desired and, 2) the file that contained the exported version of the spreadsheet data with line numbers. The only real problem with this MAPS procedure was in changing it after the fact to alter the shape or features of the graph. Changes necessitated the use of an editor and an understanding of the syntax of the question and answer procedure file. Problems encountered here included multiple steps when just a simple change from a bar graph to a line graph was desired, and difficulty in interpreting error messages when the changed dialog was used. When unequal intervals were tried (to skip over ranges with no data points) the data was plotted incorrectly though there was no message to this effect.

In LOTUS this test was done as described above for graphing database entries. Clearly it was an advantage to have the graphing function available to the spreadsheet without the need to export and import the data points to be plotted.

Spreadsheet Analysis of Database Data. As a final task it was thought reasonable to produce a predictive model of the enrollment data in the independent and integrated environments. This test was to predict future enrollments using a simple formula on past enrollments.

Several procedural steps were required to extract the appropriate data from NPL. One of these steps proved awkward as it was not obvious how data could be saved without overwriting similar previous data. The major difficulty encounter here was in formatting. Whereas SC20 required a separate row or column for each year of enrollment data for a given course, NPL could only produce such a row for a given course (it could not put in a similar row for other courses). This problem was solved in SC20 by using the row and column movement commands to move the data into the correct position where formulas could be used to generate predictions (which were printed without difficulty).

The analysis of database information in LOTUS was also difficult and the most taxing task LOTUS had to accomplish. The reason for this was the involved nature of the formulas used to analyze spreadsheet data when structured as a database. These formulas which averaged or counted things in particular fields (i.e., spreadsheet columns) or selected specific records (i.e., spreadsheet rows) required three arguments. First the database dimensions (or name for the range representing the corners), then the offset for the field being considered, and finally the cells holding the criterion for choosing specific occurrences.

Given LOTUS's ability to copy formulas it was not anticipated that even these complicated formulas would be difficult to manipulate, but it was discovered that the argument for the offset (to choose the field) did not adjust though it could be said that this might not be reasonable as strictly speaking, it is not an actual address.[1]

What proved most distressing was that the results of these database formulas (which were used to compute the averages used in the final prediction) did not allow the averaging of their results as simple LOTUS formulas would. When the results of these formulas were averaged, all that resulted was zeros as the formulas were treated as zeros because they appeared to LOTUS as labels. This was solved in the somewhat circuitous fashion of saving part of the spreadsheet in a print format file and then importing it and doing further computations on the simple numbers (without their intervening database formulas). It was also possible to retype each component of the average to be computed as its original formula — thus producing one huge formula -- much longer than a single line. Such a formula was copyable though again the offset had to be adjusted manually.[2]

Once the desired numbers were computed, adding headings as LOTUS labels and grouping the results in a corner of the spreadsheet allowed the direct printing of the predictions as a simple report.

It also became obvious in doing even these simple predictive calculations in LOTUS, that a common 8088-based microcomputer with 256 K memory was being pushed to its limits in terms of its calculation speed. With the MBA database already having been truncated to fit into this machine's memory, the recalculation time was annoyingly slow and typically approached two minutes -- for no more than several dozen formulas -- albeit ones which considered most of the data in the spreadsheet.

As a comment on both NPL and LOTUS, it should be mentioned that the task of importing the MBA data in the first place required that the data be specially formatted with quotes and/or special grouping of fields. This was done using the SNOBOL string processing language on a mainframe computer and then downloading the resulting file using an asynchronous communications package (Sheehan and Newsted, 1984). Though this task was not difficult it is likely that a typical end user would have neither the resources nor the

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[1] In retrospect it may have been more reasonable just to export the relevant parts of the spreadsheet cum database to a separate disk file, (as these extracts would overflow memory), manipulate each part individually, and then manually re-enter the results. The initial attractiveness of being able to do everything on one spreadsheet is quite seductive, however.

[2] As has been pointed out by at least one experienced user (Ashton, 1984) the weak database capabilities of LOTUS can be surmounted by any user who has become proficient with LOTUS macros — in fact some feel this is LOTUS' main virtue and would not use it without them -- thus tactitly admitting that they have become "closet programmers".

DP skills to accomplish this conversion and would have to rely on specifically tailored micro-to-mainframe linking packages.

It is also reasonable that this linking may be an overrated need. Much use of mainframe data on micros for decision support may involve only a relatively small set of pertinent numbers which could be easily copied by hand and retyped without the need for a sophisticated communication package.

Comparison of Approaches

In this section we discuss the three dimensions, dialog, data, and model usage to give an overall comparison of experiences with these packages. Figure 2 helps tie these concepts into the specific tasks performed and illustrated in Figure 1.

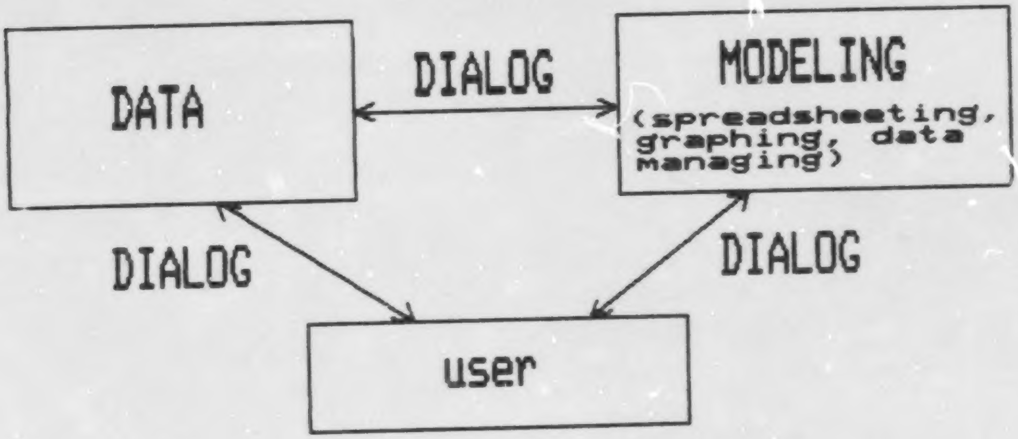

FIGURE 2: DIALOG Relationships Between DATA, MODELING TASKS and user.

Dialog. This aspect of a decision support system (DSS) is perhaps the easiest one to evaluate because it is the most obvious, and is something which must be clearly understood in order to use a system. However, it should be noted that learning separate dialogs for three different packages provides a weighted situation in which the three dialogs are bound to appear more complex than a single dialog for an integrated package -- even if there are different aspects to the dialog for different functions in the integrated package.

With this caveat in mind, LOTUS is still the clear winner in two of the three functions studied: spreadsheet usage and graph creation. With respect to spreadsheet creation both LOTUS and SC20 allow for selection of operations from a menu, but the choices in LOTUS are not only more mnemonic with full words rather than SC20's single letters, but also more variable in that either the first letter of the command can be used or the cursor can be moved to the command to make the desired choice. It is further the case with LOTUS, that any unclear commands can be queried with a help screen whereas help in SC20 requires scanning an abbreviated manual.

In creating graphs, LOTUS employs the same use of keywords as is done in manipulating a spreadsheet. MAPS uses an interactive dialog procedure. If one follows the MAPS suggestion and lays out a rough picture of the desired graph beforehand, the dialog procedure is not difficult to use, however, if one behaves more typically and just experiments, frequent references to the manual are needed to see what response(s) should be given to each question. There is no provision to backup from a choice -- as can be done with the "escape" key in LOTUS. If one wishes to change the dialog in MAPS, an editor must be invoked and a string of responses must be changed. Clearly the ability to move easily among the branches of the LOTUS menus makes this an easier task -- not to mention the fact that one need not learn a separate file editor.

When handling data, LOTUS' menus do not seem to be an advantage, however. LOTUS can select records, generate reports (which can be printed), and can sort data on various fields, but numerous steps from the menus are involved and extra areas of the spreadsheet must be used to hold selection criteria or report headings. This proceeds more simply in NPL with its English-like query and reporting language. Format headings can be generated automatically as well. Though ranges provide some naming capabilities in LOTUS, the ability to mention a field name (or its shorter alias), allows quick data access in NPL. NPL also has the ability to create a screen or data entry form with basic error checking of values. Some of this is possible in LOTUS but only with extensive use of macros and hence, reliance on what then becomes a procedural programming language.[3]

Data. Though a package's ability to handle data cannot be fully separated from either modeling or dialog, as has just been seen in the previous discussion of dialog, there are other aspects of data handling that should be mentioned in considering the independent packages as well as LOTUS.

The main virtue of data in a spreadsheet is its immediacy or obviousness. It is right in front of one at a screen — the concept of a file seems quite distant. This is true in both the LOTUS and the SC20 spreadsheets. Further it is easy to move around in or change data in either of these spreadsheets. Thus they both seem to handle data with ease.

In dealing with data for graphs, LOTUS provides a more obvious way of storing the data; it is directly represented in cells of the spreadsheet -- little else is stored other than the menu choices which determine the format. In MAPS the data is stored as special lines in the dialog file, and as has been mentioned, an editor must be used to change them. Both LOTUS and MAPS have the flexibility to graph different data with the same format. In LOTUS one need only point to different rows or columns while in MAPS a different file can be read, or different lines in an existing file can be referenced. As has been mentioned, MAPS has the limitation that only data for one axis of the graph can be stored. This restricts MAPS use to those limited situations where the other axis is some predefined scale such as consecutive days or fiscal years.

Finally, when one looks at data in a more aggregate sense of it being stored in a database or file, one is struck with the "busyness" of the LOTUS data. Its very obviousness makes it all pervasive. It is everywhere.

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[3] It is encouraging to note that LOTUS' new integrated system Symphony has both screen painting and data validation as built-in features.

Though it can be grouped either by ranges or in separate spreadsheets, this must be done consciously, and one must remember to check for range names as well as the importing or exporting of data between spreadsheets. If one does not have data processing experience or background this lack of files may be seen as a simple way of dealing with data. Those with DP experience will probably prefer the NPL approach whereby there are explicit data files with explicit field names and field specifications. One limit of this latter specification is its exactness. It is nontrivial to add or delete a given field. A data manipulation tool like NPL also is limited in its ability to combine files. Though a newly announced version of NPL purports to have full relational capabilities this is not the case with the current release, hence the inserting and selecting of data columns and rows (often based on specific criteria) is more powerful in LOTUS and approaches the power of relational joins and projects.

Modeling. This is the weakest aspect of all of the packages. Only basic arithmetic and some trigonometric functions are present and there is no suggestion as to how these features may be used to model or predict a given trend. One has to resort to manuals (if they can be found) to do a regression or time series analysis if one is going to use more than simple formulas.

These formula manipulations are equally powerful (given the above reservations) in the spreadsheets in both SC20 and LOTUS. LOTUS probably has an advantage with both its better user's manual and help features and its macro capability. In modeling with graphs, neither package allows curve fitting or manipulation of the visual data once it is generated. As was mentioned initially, this is a rather advanced modeling skill and not likely one to be needed by most users.

In even simple modeling with the data function of these packages, there is a serious problem with what is possible in LOTUS. Its database functions behave differently from its straight functions. The results of these database functions (those that start with @D) cannot be further used in computations because all that LOTUS sees is a string of characters which it treats as a label rather than the number which would be the result of the formula which this string of characters represents. Ordinary functions in LOTUS are not similarly affected. This problem with the simple "modeling" with basic arithmetic functions is not present in NPL as the results of a formula are presented simply as numbers which can be stored in a file for later reference or use.

Some Final Observations

There are a number of conceptual frameworks which have been evolving to provide a theoretical basis to understanding the decision support systems (DSS), which these packages allow one to build. Sprague and Carlson (1982) is widely quoted and seems to represent, with other texts such as Bennett (1983) and Thierauf (1982) what, for lack of better terms, may be called a data processor's or a "mainframe" perspective. There is also the point of view of the end user or the amateur data processor (Huff and Rivard, 1983) or a "microcomputer" perspective. This latter view focusses on user's particular concerns (e.g., spreadsheet analysis, graphics, text processing, report generation, data management) and users' overriding concern about how easy the system actually is for them to use in their work. This ease of use issue includes how the functions are integrated and, except for the interesting work of Holsapple and Whinston (1984), not much outside the trade press has appeared which helps one to tie these user issues into the conceptual DSS frameworks.

It may well be that it is too early in this rapidly changing field's development to expect that multifunctional micro software as DSS generators would fit neatly into existing DSS theory. However, the new products like Noumenon Corp.'s Intuit, Ashton-Tate's Framework and LOTUS Development Corp.'s Symphony need to be understood and objectively evaluated. For example, it may ultimately be concluded that these "super integrated packages" are actually just too much for a simple user. One user told us (Ashton, 1984) that his needs would be satisfied if LOTUS were to offer just the powerful Symphony spreadsheet. Many users are confused by the volume of material in three manuals needed to explain this package's other four functions. Hence, concepts and tools which help to measure and clarify practical strengths and weaknesses of new packages are a definite necessity.

References

Ashton, T.H. Senior Budget Analyst, The University of Calgary, Private Communication, November 26, 1984.

Bennett, J.L. Building Decision Support Systems, Reading, Mass.: Addison-Wesley, 1983.

Holsapple, C.W. and A.B. Whinston. "Aspects of Integrated Software". 1984 AFIPS Conference Proceedings, Reston, VA: AFIPS Press, 1984, pp. 311-317.

Huff, S.L. and Rivard, S. "The Amateur Data Processor: A New Organizational Role". Business Quarterly, 1983, Winter, pp. 125-131.

LOTUS 1-2-3 User's Manual, Lotus Development Corporation, Cambridge, Mass: 1983.

MAPS/PRO Graphics (User Guide), Digital Equipment Corporation, Maynard, Mass: 1983.

Sheehan, B. and Newsted, P. "Information Support for Planning in Academic Subunits," paper presented at 19th Annual International Conference, Society for College and University Planning, Cambridge, Massachusetts, July 1984.

Sprague, R.H., Jr. and Carlson, E.D. Building Effective Decision Support Systems, Englewood Cliffs, N.J.: Prentice-Hall, 1982.

SuperComp-Twenty Handbook (A Guide to Revision 1.0), Access Technology, Inc., South Matick, Mass: 1982.

Tetlow, W.L. Demonstration of National Center for Higher Education Management Systems Micro Software Products. Canadian Association of University Business Officers, Calgary, June 1984.

The NPL Information Management System (The User's Guide for the Professional 350), Vols. 1 and 2. Digital Equipment Corporation, Maynard, Mass: 1983.

Thierauf, R.J. Decision Support Systems for Effective Planning and Control: A Case Study, Englewood Cliffs, N.J.: Prentice-Hall, 1982.

Track VI
Promises and Perils of Technology

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WATCH THAT FIRST STEP!

Transition From Plan to Reality

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ABSTRACT

Embarking last year on a $13.5 million, six year Long Range Information Systems Plan,* the University of Miami is now beginning to reap the benefits that were promised. The Plan outlined 44 applications, most of which are to be installed in a database environment via prototyping with fourth generation tools. As with any large, ambitious endeavor, there have been numerous unplanned obstacles encountered and errors made along the way.

In spite of the challenges, the initial phase of implementation has been successful. Steering Committees, comprising interested users for each project, and a Computer Advisory Committee, made up of senior executives and academicians, oversee the Plan's execution. Most important, our first application systems have been completed within a timeframe which is astonishingly close to our planning approximations.

This paper deals with the challenges, both political and technical, which confront Information Systems Management (ISM) today, and offers the benefit of our experience in successfully overcoming these potential roadblocks.

* See CAUSE papers, December, 1983

WATCH THAT FIRST STEP!

Transition From Plan to Reality

INTRODUCTION

The University of Miami, a private, independent, nonsectarian university was chartered in 1925 as a nonprofit institution of learning, whose policies are established by a self-perpetuating Board of Trustees. The University serves approximately 20,000 credit and non-credit students each year. The Information Systems, Planning & Institutional Research organization supplies the information, services and facilities needed by the University to support its institutional objectives, along with providing staff support to the President as the chief planning unit.

This marks the end of the first year of what may be one of the most ambitious administrative data processing endeavors ever undertaken by a university. Its principal challenges involved: (1) managing 48 persons working on six separate but related application development projects, (2) migrating from batch UNIVAC processing to an on-line IBM environment; and (3) learning to install and operate an integrated institutional data base.

THE PLAN

In 1983, the Information Systems organization was so burdened with maintaining old, poorly documented, batch UNIVAC systems, that it could not make sufficient headway towards new system implementation. The clamoring for new systems was relentless, but the ability to deliver was constrained. In an unorthodox move, the University suspended all new systems development activities for four months, in order to put together a Long Range Information Systems Plan (LRISP). Two teams were formed; senior personnel were assigned to develop the Plan, while others formed a team devoted to reducing the backlog of maintenance work. In a period of four months, the Plan was completed. It consisted of approximately 250 pages and contained six major strategies for the future of information systems at the University of Miami. The following summarizes those strategies:

Application Strategy. After extensive interviewing, the information needs of the administration were assessed. Based on these identified needs, 44 application systems were recognized and described to meet the information needs. These application projects were prioritized, according to the needs of the institution and the availability of data. The prioritized projects were crudely sized (as small, medium, or large) and a 7 year overview Gantt chart was prepared (See Attachment).

Hardware Strategy. The hardware strategy was founded on three distinct architectures; university-wide, shared local, and personal. The university-wide architecture would rely on multiple IBM compatible mainframes so that the growth path would accommodate a redundancy in processors to help insulate critical on-line applications, such as on-line registration, against catastrophic downtime. The shared-local architecture accommodated multi-user minicomputers and microcomputers, as well as clustered local area networks. The personal architecture encouraged the use of single-user personal computers where appropriate.

Communications Strategy. This strategy proposed the installation of an integrated voice/data switch to allow terminals and computers to be connected to the University's telephone network. Additionally, it recognized the need to provide a large dedicated network for high-volume data processing needs.

Office Automation Strategy. The strategy addressed the needs for facilitating, coordinating and advising activities, as opposed to strict regulation, in a rapidly changing technology.

Organization Strategy. Recognizing the need for people and space, this strategy called for the inclusion of 42 additional persons to the existent organization for the implementation of the ambitious Plan. The need for executive and management oversight committees to guide the progress of the Plan was also addressed.

Systems Software, Data Base & Security Strategies. These strategies outlined the technical environment, the global data base architecture, and the security directions to be followed by the University.

THE REALITY

Looking back on the first year's activities under the Plan, we can see complete success in meeting the objectives set for the year. The ambitiousness of the Plan, however, has left the scars of experience on the participants (developers and users alike). Below is a report of our progress during this period of adjustment.

Application Strategy. As with most challenging endeavors, the most difficult period is during the start-up. During the initial period, Arthur Andersen & Co.'s METHOD/1 systems development methodology was adopted and installed for guiding the development projects. In concert with the system sponsors a project steering committee, comprising key interested users for each application system project, was formed. Project planning and time reporting systems were acquired while at the same time a "Programmer's Workbench" containing technical standards, methods, procedures, and guidelines was developed. There were four scope and priority changes approved during the year for the application development projects. In spite of the obstacles, the two application projects scheduled for delivery during 1984 were delivered on schedule, and all but one of the remaining projects were on schedule according to their published plans.

Hardware Strategy. A second processor with increased main memory and channel capacity was acquired and installed. Mass storage was increased by 2.5 billion bytes, and two data paths were implemented in order to reduce "bottlenecks". A capacity planning function was instituted, in order to monitor existing systems and forecast future hardware requirements. A shared local minicomputer system for the Athletics Office was installed, and growth in personal computing has been exponential. To aid this proliferation, a campus computer store has been opened in conjunction with the bookstore.

Communications Strategy. A voice/data switch, (AT&T's System/85), has been installed and converted. The dedicated network has grown from 30 to some 300 terminals. A University committee is evaluating alternatives for a high capacity dedicated communications network.

Office Automation Strategy. A Computer Acquisition Guide was published recommending product search procedures and evaluation criteria for basic hardware and software requirements. Requirements were determined for network compatibility and consulting support eligibility. A list of approved products was established. Projects to evaluate and standardize on available software (Word Processing, Spreadsheet, Data Base Management, Graphics, Communications and Integrated Software) and on mainframe information extraction, formatting and downloading products were completed. The focus of the original Office Automation strategy had been too narrow, and was expanded to become the End-User Computing Support strategy.

Organization Strategy. The plan to recruit and house the additional qualified personnel was accomplished. Off-campus rental space was acquired for the development staff. A construction plan is underway for remodeling the main computer facility. However, the lack of sufficient contiguous space hampers staff productivity. User involvement in systems development was addressed from several angles. A Computer Advisory Committee (CAC) was formed to oversee the Plan's progress and address issues of project scope and priority. This group has approved a series of much needed computer policy statements. Each project has a steering committee consisting of key management users of the particular system. They have oversight, scope, and input responsibilities for the active projects. Two experienced users were assigned full time to each project as "Information Analysts".

As the first applications reached the design phase, it became apparent that the database support staff required additional personnel resources. Three individuals were reassigned to support this function. An Information Center was formed to assist the University's knowledge workers with the problems of extracting and analyzing data base information, along with general software consulting support for mainframes, minicomputers, and microcomputers.

Systems Software, Data Base & Security Strategies These supporting strategies are evolving as more information is learned about the technical environment. Security administration can be a major challenge in a shared data base facility. Data base technical support has been most challenging, and the tasks involved in supporting massive concurrent development in addition to routine maintenance are now being seen. It is now becoming much more evident why supporting six concurrent application projects has been called ambitious and challenging.

THE LESSONS

There are many dead-end streets to travel, traps to fall into, and obstacles to overcome in implementing an aggressive IS plan such as ours. This section describes some of the major issues we dealt with, and describes our experiences and warnings to others who may travel the same route. These issues are divided into the following categories: 1) Management Issues, 2) External Issues, and 3) Internal Issues.

Management Issues. Beyond the first six months, a multi-year plan is, at best, little more than a goal statement and an educated guess. Even though our projects were crudely sized, and our financial projections stated in the context of broad ranges (and rounded to the nearest tenth of a million dollars), the general user community and management groups viewed these rough forecasts as precise estimates. Experience shows that this misconception, despite all efforts at explanation, is almost always the case. This clearly points out the need for conservative forecasting, allowing an extra margin of error to offset the natural human tendency to underestimate, since the commitment to these forecasts by the administration is implicit.

Another chief problem has been the lack of planning consideration for the learning curve for new tools and techniques. This phenomenon was recognized, but not forecasted, since it was assumed to fall within an already broad margin of planning error. This factor has accounted for approximately 15% overruns on initial projects, and can be an on-going factor which is significantly impacted by the rate of personnel turnover. Using a new technology, such as fourth generation languages, requires extra effort for mastering the new tools. An allowance should be included for this, particularly with regard to initial projects.

One of the largest challenges has proven to be the absence of clear policies and procedures to guide the organization, both internally and externally, in bringing the Plan to fruition. As the needs were recognized, the University Computer Advisory Committee has approved the following policies and procedures:

- Acquisition of Computer Hardware and Software Policy
- Data Communications Policy
- Data Management Policy
- Security and Control Policy
- Charge-out Policy
- Information Analyst Funding Policy
- LRISP Telecommunications Hardware Costs Policy

Internal standards and procedures, functioning as our "rules of the road", have taken management effort far beyond what was anticipated. Without these rules, the lack of standardization would create an impossible situation for rapid concurrent development. These standards and procedures are still under development, and previously implemented standards are reviewed and revised on a continuing basis.

External Issues. Extensive user involvement is required for systems implementation in any large organization, especially one as diverse as a university. This level of involvement has its price to be paid. During the year, there were four separate major scope revisions to planned projects. Three of these involved combining lower priority projects with higher priority ones, which delayed the planned starting dates for subsequent systems under the Plan. In the absence of heavy user attention and participation, projects may be seriously delayed, jeopardizing the credibility of the Plan, and creating unnecessary hardships on project members. The lesson here is to solicit and secure user commitment and involvement early in the project, and to keep working with them throughout the project to informing and involving them in the decisions that must be made. Failure to do this will result in last minute vetoes, and emotional reactions, all of which will detract from delivery of the system.

One of the largest impediments has been the skepticism of the users and their natural resistance to change. The information systems profession has historically done poorly in delivering their promises. This prevalent attitude is difficult to change and trust has to be established. The lesson here is to "promise what will be delivered, and deliver what is promised". Over time, a strong delivery record will win out against distrust and reluctance.

A growing concern that bears watching is the rate of change which the user community can tolerate. In bringing up an application, much user attention has to be diverted from critical day-to-day functions. After a system installation is complete, there needs to be a period of accommodation to the new procedures and methods before another project can receive its necessary level of user attention. With a massive concurrent development Plan, the user's tolerance can be exceeded, with possibly devastating results.

Internal Issues.

At the time that the Plan was drawn, hardware capacity was the single most difficult factor to forecast over a multi-year horizon. A general growth plan consisting of multiple mainframes was stipulated. However, our existing processor, an IBM 4341 Model 2, was saturated during the first year of the Plan, at a time when only 1 small application was placed online. Heavy development activities consumed far more resources than anticipated. An earlier emphasis on capacity planning could have anticipated this saturation, and prevented capacity snags so early in the life of the Plan.

As the first two projects reached the stage of ordering communications hardware and terminals, an internal reorganization was necessary in order to centralize the management of the communications network. With massive on-line development, the network is never in a steady state, and unless there is centralized control and capacity analysis of the network, short term decisions can result in an inefficient network investment. The recognition of the need for centralized management of the network has protected us from being "penny wise and pound foolish" with regard to the installation of communications controllers and lines.

The concept of sharing a university-wide data base was widely accepted during the planning activity. However, experience has shown that the design and management of the data base security environment is a monumental task. We have had to design and implement a "home grown" system allowing various groups of users to access only "their" information in the shared data base. For example, the access of student grades by a particular school, while in the data base all student grades are logically stored together. We have been active in establishing a security environment that is decentralized through the use of designated "Security Custodians".

After experiencing the first elevation of a newly developed application to production status, we learned that this is an extremely labor intensive exercise for the data base unit. Additionally, the labor involved is specialized, scarce, and expensive. In hindsight, an automated approach should have been developed before this first need. The data base personnel are so saturated now that it is difficult to free up sufficient time to improve the process.

We were fortunate to have clearly seen the need for a development and training function to aid our professionals. This need is often overlooked, but our dependence on new tools and methods required such an ongoing activity. We are now seeing an expansion of the scope of this group to end user education in the basic tools of the Information Center.

On the down side, stress & burnout have taken their toll. With the high visibility of a multi-million dollar endeavor. the publicized schedules and deadlines, and the risk inherent in estimating with unfamiliar and untried tools, there were several instances of stress related illness. However, the teamwork and peer support given these individuals has done much to mitigate the effects. All personnel who have experienced this syndrome have fully recovered and are handling even greater challenges. The fact remains though, that high stress is a constant in our work.

Employee turnover during the first year under the Plan has been minimal. The exposure grows, however, as more and more local firms begin to use the same data base product. Their expansion places a premium on the skills that we have learned.

Our largest problem has been space. Space for people, space for machinery, and space for storage. We now recognize that we just did not consider this strongly enough when preparing the Plan. People need space in which to function, just as they need pencils and paper. It is a basic need which should never be overlooked.

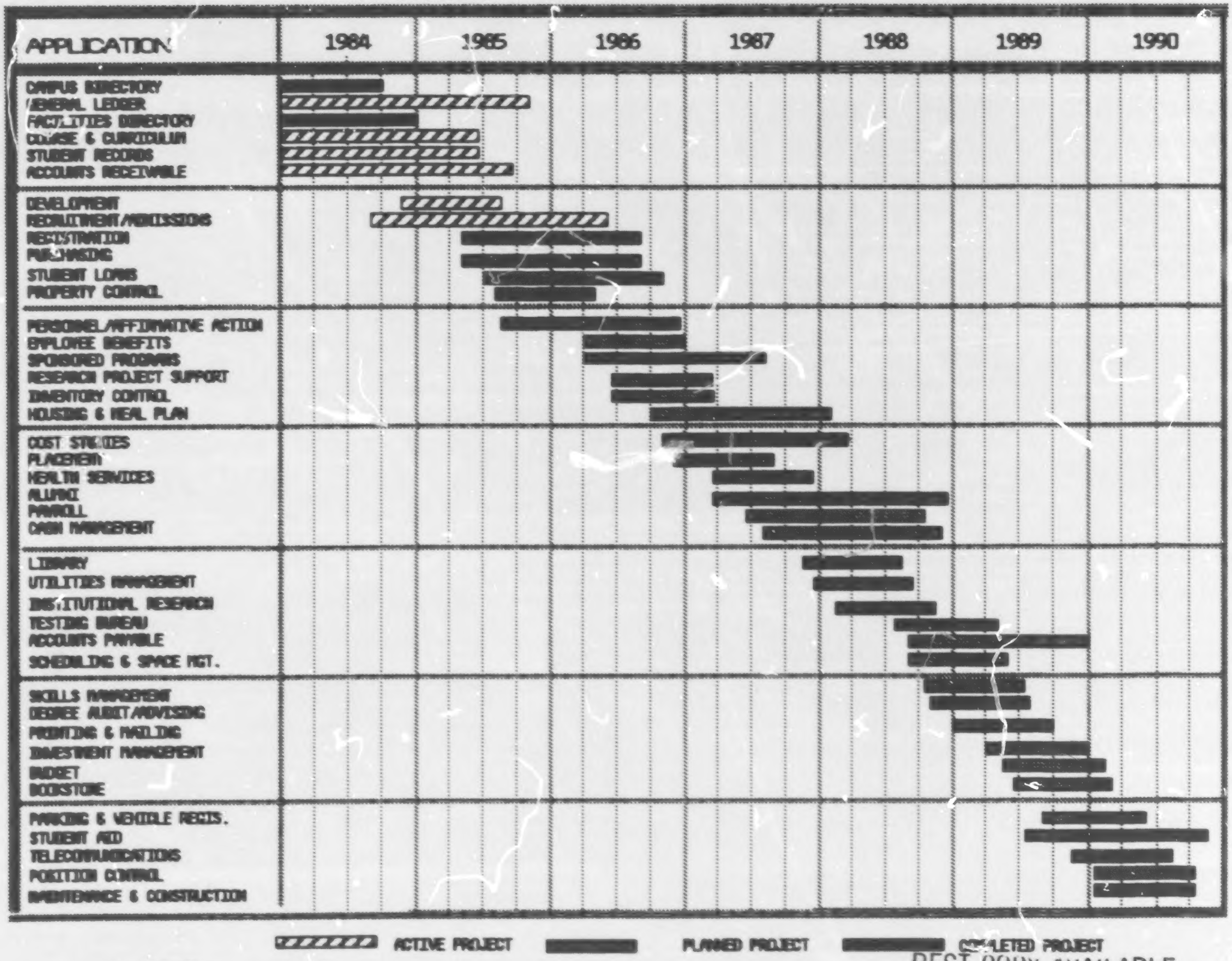
SUMMARY

The creation of a Long Range Information Systems Plan forms the basis of a common goal for the organization, describing a desireable future state of affairs. It channels the day-to-day decisions towards the realization of that future environment, rather than leaving the future to happenstance. Planning is not an activity performed in isolation, but is best served by the participation of those who will seek to bring it to fruition.

In order to succeed, we must pay more attention to Information Systems Management. Unfulfilled plans are legion, having been relegated to the shelves of good intentions. A working plan must be dynamic, but not capricious. It should be molded by reasonable adjustments, based on the wisdom gained from experience. There has been an entire profession built upon the premise of "planning the work" and "working the plan". The profession is called "Management".

UNIVERSITY OF MIAMI

LRISP IMPLEMENTATION OVERVIEW



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Organization for Communications Network Services

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Abstract

Virginia Tech reorganized its computing and communications activities under a Vice President for Computing and Information Services. Strategic changes have been the intergration of all voice and data communications activities, including management, acquisition, distribution, and maintenance of intelligent workstation facilities. Factors that influenced this reorganization were: first, availablity to faculty, staff, and students, of large interactive centralized computers; second, development of specialized applications on distributed computing facilities (e. g. library catalog); third, rapid growth of on-campus workstations (especially personal computers) - over 5000 by October of 1984; and fourth, rapid deterioration of the communications (technological and support) infrastructure's capacity to meet data users' expectations. This paper discusses the mission, rationale, and goals for Communications Network Services organizational units - Network Control, Business Office, Planning/Engineering, Workstation Services, and Software Development - and reviews management considerations relevant to priority development projects (one with projected expenditures of over $10 million).

I. Introduction

Perhaps no other area within the University is undergoing such enormous transformation as that of the communications organization and facilities. In early 1984, the University announced that a new department for communications services was being established. The new department, Communications Network Services, reports to Dr. Vinod Chachra, and merges the responsibility for communication functions into one organization within the University. Prior to the announcement, voice, data and video communication responsibilities were being directed by three University Vice-Presidents.

The purpose of the new department is to ensure the development and management of a communications infrastructure which supports university information services effectively and efficiently. Dr. Chachra has defined three major goals for our new department.

FIRST, the department is to ensure the continued availability of basic, reliable, and competitively priced communications services. The geographic area covered by these services is the main campus (including the dormitory and dining hall facilities), the greater Blacksburg area and the Commonwealth of Virginia.

SECOND, the department is to ensure the availability of advanced functional capabilities in state-of-the-art communications systems which are critical in overcoming the geographical isolation of Virginia Tech. The advanced communications functions are necessary to continue the strong and competitive position of the University in meeting its research, extension, and instructional missions.

THIRD, the department is to develop and maintain a five-year plan for the acquisition, development and management of a consolidated University communications utility.

II. Planning

As we organize for the future and direct our mission to making Virginia Tech a leader in communication technology, the need for organized and directed planning naturally evolves as an essential component. The department's Director, the Manager, Administration and Development, and two senior technical engineers are addressing the planning aspects for communications at Virginia Tech. Two key issues are being addressed: first, the continuing rapid rise in cost for communications and second, the realization that our communications infrastructure is not able to support information distribution requirements inherent in our complex information oriented community.

During the first months as a department we have been devoting serious effort and engery to defining both the short and long range plans

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for communications. We realize that if we are to achieve our mission the requirements for both narrow bandwidth and wide bandwidth must be skillfully addressed. For purposes of planning we define narrow bandwidth as 64 kbps and below and wide bandwidth as greater than 64 kbps. The current environment of almost 3,000 connections is supported by a local area network, Sytek's LocalNet 20, or by point to point connections - either 3270's on coaxial cable or asynchronous terminals and PC's on twisted pair. The current technology reflected in these facilities will not meet our near future capacity and connection requirements.

At this time we are negotiating with two major communication vendors for joint research projects relative to the developing of our broadband facilities. While we are investigating and actively pursuing the economic and technological advantages inherent in a broadband based network, we are formulating the requirements for an on-premise digital switching facility. This has the potential advantage of integrating some data communications services with voice/telephone. With the recent divestiture of the telephone industry, it is a most opportune time for the University to examine the overall voice and data requirements and embark on a long range plan that will address its needs into the 1990's.

III. Administration and Development

The UNIVERSITY community has fallen in love with innovative ventures and this is necessary for it to be a leader. The implementation of new ideas requires substantial administrative support and University resources. As the University communication facilities are being reorganized, perhaps the single area that requires the largest amount of revamping is the Administration and Development Section.

The new department combines the administrative support functions for voice/telephone and data communications. It also includes work station equipment maintenance and the management and operation of the newly formed Personal Computer Auxiliary.

The following sections: Voice/Telephone Communications, Data Communications, Personal Computer Auxiliary and Software Development, outline the details of Administration and Development.

1. Voice/Telephone Communications

Divestiture of the telephone industry has mandated that certain administrative changes be made. Information that was being reported to us before is no longer available. We are currently in the process of creating our own data base to include all telephone lines and equipment in place at the University. We will be able to update the data as lines or equipment are added and deleted. This office places all orders for telephone installations, moves, and removals. Before divestiture we were issuing approximately 1000 written orders per year. Today, we are generating double that amount, one to Bell Atlantic for the lines and the other to ATTIS for the equipment. Internally we are evaluating the order process and plan to automate and streamline the task. As these changes are being made, ordering and problem reporting is being transferred to the Engineering Section of Communications Network Service. They will then be handling all ordering and problem determination for the various types of communications. As with any move in responsibility, one of the primary goals is ensuring that the service level offered is equal to or better than the current operation.

With the planned introduction of an on-premise digital switching facility, the administration of voice and telephone services will be undergoing another change. Our early and thorough planning includes participation in defining the University's requirements for a new system. All accounting and billing requirements are being clearly outlined and included in the on-premise digital switching proposal. Obviously, costly and chaotic time delays can be held to a minimum if we begin early and plan thoroughly for the administrative needs.

2. Data Communications

All requests for data connections are being processed through the business office. Standardized installation request forms are being used and each request must be accompanied by a University Transfer of Funds Form. The following table represents our current connection classes and associated rate structure.

Type of Service	Installation Charge	Monthly Charge
Local Network/Broadband	$100	$25
Dataswitch/Twisted Pairs	$100	$25
327x/RG-23 Cable (time and materials)	$300-$2,000	$17

Last fiscal year, over 1,000 data connections were installed. We are currently receiving requests on an average of 100 per month. These requests are the basis for the majority of the departments equipment acquisitions. As a new department we are reviewing and revising our in place billing system to include inventory controls for leased equipment. Departments are billed annually for data connection services. The most important factor for billing is maintaining an up-to-date and accurate inventory of installations and equipment locations. During the installation process, our goals are to install the connection as quickly and efficiently as possible and record the inventory information. Ensuring that our records accurately reflect the connection is a very difficult job. Over the years, this had not received the necessary attention, consequently we are having to perform a University-wide data connection inventory, on a building- by-building basis.

The inventory will take at least 600 manhours or approximately four months. One thing is certain, we're finding better and more accurate ways to manage the inventory. As a department supported by expenditure refunds we must recover the costs inherent in every communication connection. From the entering request through to the installation four systems are interfaced: equipment acquisition, billing/accounts receivable, accounts payable, and inventory control. It is impossible to define where one system ends and the other begins. The importance each system has on the success of a data communications business must be given due consideration.

3. Personal Computer Auxiliary

Communications Network Services assumed responsibility for the Personal Computer Auxiliary in March, 1984. This program's main purpose is to make available to faculty, staff, and students personal computers at less than retail cost. The savings for this program are made possible through contracts with various personal computer manufacturers. The department currently administers two contracts for personal computer equipment and various agreements for software.

This program involves significant contributions in time and effort by many University departments including, but not limited to, the University's Accounting Department, Purchasing Department, and the Treasurer's Office.

One major initiative driving this program has been the acquisition of personal computers by freshmen engineering students. In fact, they account for 52 percent of the systems processed year-to-date. The overall scale of this program is reflected by the table below. Expenditures for systems thus far total almost five million dollars.

Personal Computers Distributed

Virginia Tech Departments	600
Faculty/Staff	155
Students	304
Freshmen Engineering Students	1185
TOTAL	2244

When the auxiliary was established it assumed responsibilities previously handled by the Hardware Services section of the Computing Center. A small number of orders had been processed, and the systems were beginning to arrive. These orders represented standard system configurations and optional hardware and software. The manual order system worked smoothly. However, the delays in receiving the units were often unacceptable. There was no in place inventory system, making invoices almost impossible to verify. Perhaps our (and the vendors) most serious problem was that monies being collected from private orders were deposited into the Commonwealth of Virginia's Treasury with on approved method for retrieving it to pay the invoices.

One of our first steps for organization was to analyze the administrative requirements associated with managing and operating a business with annual revenues of eight million dollars. That was almost nine months ago and we are continuing to identify areas for review and revision.

An automated order system has been developed. The system runs on a PC XT using dBase III with in-house developed software. The order system provides monitoring of the order from the time it is placed through to the payment of the invoice. Pertinent data are being recorded: prices and related dates, order date, ship date, equipment received date, packing slip data, invoice number, invoice received date, delivery date to buyer, part and model numbers, and serial numbers. Once the system has been delivered to the buyer the warranty period begins. At the expiration of the warranty the individual may elect to purchase a maintenance contract from the auxiliary. The monitoring of warranty expiration is also a part of the automated system, which prompts us when system warranties are nearing expiration. All in all, the systems are working nicely and are supporting our current administrative requirements.

The requirement that freshmen engineering students have a personal computer this year greatly increased the amount of work handled by the auxiliary. Due to the the systems ordered, methods of payment, and delivery process this program was handled separately from the regular private orders. Almost 1,200 systems were ordered and delivered at one time. As we begin our planning for next year, certain areas are changing. However, because of the sheer volume and timing the engineering orders will remain separate from the regular ordering process.

4. Software Development

An important part of the Administrative and Development Section is the sub-unit, Software Development. The software projects are managed by an excellent Senior Systems Engineer. He utilizies the University's resource of graduate students from the engineering and computer science fields to produce some unique software systems to support the University's communication needs and the department's administrative needs.

Parameter Contamination System - addresses the LocalNet 20 connections and checks the parameters for each port to verify that they are correctly set.

Data Switch Directory Recovery System - provides a mechanism for relocating the data switch directory information (lines, connections, logical names, error messages and etc.) via a personal computer/ data switch connection. Previously there was no means for a backup system. If the data switch encountered a disaster all information would have been lost.

Name Server - will allow us to make connections to LocalNet 20 using logical name versus the current numerical call. It will also allow us to collect accounting/billing data for the dial up lines.

This system will reduce the bridging on sub-channels by seeking a host port on the connected channel. One of our most frequent complaints is the lack of queing for a connection. This software supports that function.

Telex System - is being used to create messages on a personal computer and transfer them to the Western Union's Easy Link system. Internally developed software and the software package Gram-A-Syst are used with the system. This system allows us to electronically receive messages from the University community and transport them to their destination. We are also receiving messages from outside sources and electronically relaying them to their recipients. This mechanism is a very efficient time saver.

Auxiliary Software - As noted in the discussion of the Personal Computer Auxiliary, the administrative software has been developed by this sub-unit.

IV. Engineering

The Engineering Section for Communication Network Services covers a broad range of telecommunication activities directed toward building and managing a custom network for the University. Details of these functions are outlined in the following sections.

1. Design/Capacity Planning/Performance Verification

The senior engineering staff designs the systems needed to ensure that the University has access to state-of-the-art communication networks. Their design projects reflect the department's telecommunication stratagies. The organizational structure as it exists has the capacity to support the design, development and operation of a network for voice/telephone, data and video transmissions.

Capacity planning is necessary to meet our growing demand for a communications network capable of providing diverse services. Almost 3,000 network connections exist today, by July, 1984 that number will be approximately 4,000. This rapid growth in communications connections is accompanied by a demand for higher and better network performance standards.

As the department improves the communications network it is important that we not limit our efforts. We must also build into the network system sufficient performance monitoring/verfication standards. The network size mandates that performance verification be a fully integrated, automated system that can detect and correct problems before they become a reality.

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2. Network Development

The objective of this sub-unit within the Engineering Section is the development and implementation of a communications network capable of supporting the University. Two lead Electrical Engineers and a Systems Engineer direct the development of system components designed by the senior engineerng planning staff. The network installers from Workstation Services are currently being managed by the Network Development staff. Circuit Designers are responsible for specifying the necessary user communication interface requirements on a request by request basis. They process all requests for connection to the communications network and ensure they are recorded in the inventory system.

3. Network Operations

When the new department was organized a telephone operators section and data network porblem diagnostics and dispatching service were already in place. The combining of University communication responsibilities into one department resulted in the merging of these services. This new operation allows more efficient use of the staff and gives better response to the voice/telephone and data network users.

The planning and organizational structuring for this sub-unit will support the future installation of our on-premise switching facility.

4. Workstation Services: Recieving/Distribution/Maintenance

With the continued increase of workstations and requests for connection, the demands on Workstation Services personnel resources have been continually increasing. The majority of the Communication Network Services staff work within this sub-unit. They are utilized to install and maintain the LocalNet 20 and Data Switch network.

This sub-unit is also responsible for the communication equipment/supply ordering, inventory control, and workstation equipment maintenance. It utilizes two workstation equipment maintenance sub-contractors to perform needed repairs. It is also responsible for transporting this equipment from the office location to our work area and returning it once the maintenance work has been completed. Two key coordinators are the Dispatcher, supervising the flow of workers, and the Inventory Manager, ordering and issuing the necessary supplies.

Communication Network Services is currently reviewing the responsibilities of this sub-unit. It is possible they will be reorganized to have workstation equipment maintenance as a separate sub-unit.

V. Conclusion

As the new era of communications technology evolves, the department is pursuing its mission. However, it is faced with certain constraints in the personnel, financial, and pulic relations areas.

First, with no increase in permanent staffing our development efforts will be limited. Without these increases we cannot anticipate reaching our goals.

Second, the goals that have been set will require substantial financial resources. The University will need to establish its priorities and, if appropriate, provide subsequent funding.

Third, the University's awareness and support of the communication development projects is imperative if Virginia Tech is to remain a leader in the communications technology field.

The Cutting Edge of Network Technology

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Abstract

Two years ago, Virginia Tech made the decision to develop a communications network with the potential to support the interconnection of all on-campus faculty, staff, and student workstations. To meet that demand, data communications facilities utilizing broadband technology seemed to offer the greatest benefits for the least cost. Although we still see considerable economic and technological advantages in a broadband based network, we are carefully evaluating the potential advantages of integrating some classes of data service with telephone services in an on-premises digital switching facility. However, we do see some of the same perils in large networks based on state-of-the-art digital switch technology. This paper reviews our evaluation criteria and methodology applied in the assessment of risk associated with developing large communications networks. It uses two case studies - (1) our experience derived from the development of the broadband technology based local area network; and (2) results of our current evaluation of the state of digital switch technology.

I. Introduction

Our recently created Communications Network Services organization has one overriding goal: to facilitate information exchange to the extent that Virginia Tech, first, maintains, and second, enhances its leadership position in the delivery of instructional, research, and extension services. This charge involves the management of several major communications infrastructure development projects.

Evaluations and risk assessments integral to these projects are dictated by three elements. The first is the definition of the University's communications requirements. Second is the continuing analysis of the state and direction of communications technology developments. And third is the determination of cost constraints. The comprehensibility of these three elements is enhanced with an understanding of the dimensions and appropriate measures associated with any communications network infrastructure.

II. Dimensions and Measures

A. Dimensions:

Communications system requirements must first be considered in terms of four basic dimensions: the applications generating the information to be transported; the geographic organization dictated by the distribution of the system's subscribers; the length of the planning cycle; and organizational cost constraints.

(1) Applications:

At any large university, there exist a number of communications systems - most of which were designed and are being operated to transport information generated for very specific applications. These include at least one telephone system, probably one or more cable television systems, several radio broadcast systems, and many data communications systems. These diverse applications have in common the requirements for a definable peak information transfer rate (channel width) and for a minimally acceptable channel access capability.

(2) Geographic:

The salient geographic features at Virginia Tech, located in the mountains of southwestern Virginia, are, first, its beauty and, second, its isolation relative to the rest of the state it serves. An objective of University communications systems development efforts is to overcome that isolation.

Communications development efforts also tend to be organized, and cost justified by four distinct communities of users based on location. These geographic organizations and associated planning parameters are as follows:

(a) Campus: Classrooms for 22,000 students, residences for 10,000 students, offices for 5000 faculty and staff.

(b) Local Area: Offices for 1000 faculty and staff, residences for 18,000 students, faculty, and staff.

(c) Intrastate: Highly distributed; extension offices in over 100 counties, 20 major research projects and centers, several graduate instruction centers, significant demand for access to University computer, information, and instructional services.

(d) Intraregional/Interstate/International: Information exchange, access to specialized computer (e. g. super computers, etc.) and information services.

(3) Time:

There is a time dimension to the communications system planning effort. Although we think of this dimension in terms of changing demand and of developing technology, the first is actually a function of the second. As computer technology has developed and become dramatically more cost effective, universities have discovered serious difficiencies in the capacity and costs of communications facilities required to transport the generated information.

It is very likely that many of these same universities have found that current communications technology will not meet all of their current and projected requirements. These universities will develop, or already have developed, systems which meet their most critical needs within these technological constraints. Whatever the unsatisfied requirements are, someone is going to meet them - but not necessarily utilizing technology compatible with already installed systems. This temporal aspect of developing technology may be the most critical in defining and containing risk.

(4) Costs:

(a) Data: Costs per unit of service for data communications (e. g. connection, connect time, packets, etc.) are actually going down. With new technological developments and increasing competition, this trend will actually continue, and for the short-term, will continue at an accelerating rate. Outrage about growing data, voice, and video communications costs are resulting from dramatically increasing demand. Demand is increasing at an exponential rate - and everyone is at the bottom of that growth curve.

(b) Voice: To the death and taxes certainties of Benjamin Franklin, we might add "higher telephone rates." After over fifty years of low priced telephone services, we face dramatic increases in telephone rates. Why?

Highly regulated, non-competitive telephone utilities have been required to price local telephone services significantly below costs. This deficit has been covered by (1) pricing long distance services significantly above costs, (2) pricing local services for subscribers in highly concentrated developments (e. g. office buildings, apartments, dormatories) well above costs, (3) offering a very minimal set of services - thus limiting the requirement for high technology, high cost capital expenditures. With the divestiture of AT&T and with the increasing deregulation of the communications industry, this finely balanced equilibrium of costs and and revenues has ended.

Today, subcribers have alternatives to AT&T for long distance services (e. g. MCI's highly advertised services). To compete, AT&T long distance prices will have to decrease. With the subsidy from long distance services gone, local telephone rates will rise. Buyers of local services with users in an office building or apartment complex will be able to install their own facilities - thus "bypassing" the local telephone utility. These bypassers will not only have lower costs, but also more functional capability. For instance, they will have higher capacity and more reliable data communications services. With this second subsidy to local telephone users gone, prices must rise still more.

To compete with these bypassers, the franchised telephone companies must upgrade their imbedded technology. Again, the remaining customers of the enfranchised telephone company will pay for that overdue upgrade in technology.

B. Measures:

The appropriate planning parameters for the four defined dimensions may be developed with the forecast of the following: (1) the number of potential system users - their application requirements, geographic distribution and price sensitivity; (2) the peak number of concurrent users; and (3) peak aggregate bandwidth requirements.

III. Virginia Tech's Broadband Project

A. Current Status:

Two years ago, this University made the decision to develop a data communications network with the potential to support the interconnection of all on-campus faculty, staff, and, eventually, students. To meet that demand, data communications facilities utilizing broadband technology seems to offer the greatest benefits for the least cost. It provides the potential for supporting several thousand connections and for data transfer rates appropriate for computer-to-computer file transfers. The operating cost per connection for such a system is already lower than a system based on digital switches and twisted-pairs (telephone cable), wired point-to-point. The operating cost of a broadband based system has the potential to be significantly lower.

Today our situation may be summarized as follows: (1) we have almost 3000 connections on our data communications network, but less than 30% are on the broadband system (the rest are point-to-point connections - either local IBM 3270's on coaxial cable or asynchronous terminals and PC's on twisted pairs); (2) we are receiving requests for connection to the network at about a 100/month rate - with that rate expected to accelerate upon delivery of over 3000 IBM personal computers, most with communications adapters, in the next 12 months. To meet the expected accelerated demand for connections and for higher capacity channels, we are pressing the various broadband vendors to provide the products and support requisite to an acceptably performing and reliable large network. For instance, we will be testing a personal computer network on the broadband cable system which has a 15 times the capacity of the current 128kbits/sec channels. Although we see considerable economic and technological advantages in a broadband based network, we are carefully evaluating the potential advantages of integrating some classes of data service with telephone services in an on-premises digital switching facility.

B. Problems:

Most of our problems seem unique to to large networks. (We define a large network as one having over a thousand connections, with the potential for thousands of connections.) Data transfer requirements for the large network are from a minimum of 4.8k bits/sec to several million bits/sec. Unfortunately, there have been times when we have seriously doubted the broadband vendors' commitment to providing the products and support requisite to an acceptably performing and reliable large network.

Most of the broadband vendors meet the needs of small networks with low to moderate data transfer requirements. However, the large network/high-data-transfer users have been neglected. Until recently, this neglect was evidenced by the lack of technical support on the configuration, reliability, and performance issues unique to heavily loaded large networks. It has also been indicated by the significant deficiencies in the currently available products.

For the large network user, the deficiencies we have experienced in our broadband based system may be summarized as follows: (1) a maximum of about 2400 (given the current mix of devices and load at Virginia Tech) connections on a channel group (vendor dependent at 6 Mhz.) - WITHOUT proven, reasonably priced hardware for adding more channel groups; (2) inadequacy of a 128k bits/sec channel for applications such as computer aided design graphics, personal computer file tranfers, etc. (3) lack of network performance monitoring and diagnostic tools; (4) no accounting tools for the allocation of resources and for recovering costs.

C. Successes:

We remain convinced that our original assessment of the long-term technical and economic advantages of broadband technology based communications networks is correct.

With this University's commitment of resources to solving its communications network problems, we are now convinced that some degree of harmony exists between this University's needs and the broadband vendors' development goals. First, these vendors seem to know that their market niche is in, what we have defined as, large networks. Second, we are beginning to see deliverable products on higher capacity channels (e. g. 1 or 2 or 3 Mbps). Third, we have, with the cooperation of the vendors', developed strategies for configuring networks which can support over 10,000 connections. Fourth, with increased cooperation and participation of two major communications system vendors, our own engineering staff is developing required network performance monitoring and accounting facilities.

D. Future Developments:

(1) IBM recently announced its PC Network based on the same broadband technology we are currently utilizing at Virginia Tech. Strengths include its 2M bits/sec channel bandwidth, a competitive price, and, what appears to be, good software support for the PC interface to the network. Its major weakness is that it has no gateway for accessing other networks. Because of IBM's open architecture approach, a number of vendors are already developing products for this network.

(2) Other Services:

Master antenna television, security, and process control systems have been the traditional applications on broadband cable systems. Videotex and interactive video applications are beginning to appear on a few systems. Although several companies are experimenting with voice applications, telephone services will not be economically feasible on broadband cable systems until the early 1990's. Broadband cable systems are, however, ideally suited for the T-1 links used to interconnect digital switches.

IV. Virginia Tech's Voice System Project

A. Cost Issues:

Virginia Tech's voice related telecommunications costs have increased dramatically over the last four fiscal years - FY 1980/1 to FY 1983/4. Total telephone costs have increased at an average annual rate of 20%. A closer look at two of the larger components of Virginia Tech's telecommunications bill suggest possible areas in which cost management steps can, and should, be seriously considered.

First, charges for access to the telephone company's Centrex system accounted for over $3,000,000, or 1/3 of all phone costs during the last four years. This cost, representing fixed access charges, could potentially be cut by 50%, or approximately $500,000 per year if appropriate measures are taken.

Second, costs associated with using the state's long distance telephone network accounted for almost 44% of all telephone expenses that same four year period. In addition, these costs have increased an average of 28.7% per year, as opposed to telephone company increases of 13%. These costs have shown a distinct insensitivity to usage.

A number of cost reduction opportunities exist with a University owned telephone system:

(1) Access Charges:

Virginia Tech pays $900,000 in access charges for the 3000 CENTREX lines over which it conducts both its internal and external communications. On a PABX, requiring but 600 lines for equilivant service, this access cost would be less than $400,000 per year. This represents a clear savings in operating costs of $500,000 per year. In addition, a PABX network better insulates the University against the certain increase in access charges for both long-distance and local services.

(2) Long-Distance Tolls:

One of the major advantages of a PABX network is its ability to take advantage of least-cost routing for long-distance communications. Comparable experience at other institutions installing similar systems strongly suggests that total University long-distance costs could be reduced about 30%.

(3) Equipment, Service, and Maintenance Costs:

At present this University pays in equipment leasing, service, and maintenance costs approximately $70 per phone, per year. With a University financed and serviced network, these costs for the initial six year period would be approximately $50 per phone, per year.

B. Current Status:

Virginia Tech has evaluated the costs and benefits of developing University owned and operated telephone facilities. The requirements addressed in this study include those related to following: (1) on-campus offices, classrooms, and residents; (2) local off-campus offices, classrooms; (3) local off-campus faculty, staff, students; (4) intrastate offices and classrooms; (5) interstate. We are completing both a request for proposal for the acquisition of University owned telephone facilities and a business plan for the full recovery of operating and capital investment costs.

C. Risks:

Today, we have reliable telephone service. A capital expenditure of $12,000,000 and a significantly larger and more complex communications organization will be required to develop and operate a University owned facility. The challenge will be in the smooth transition to the new operation and in providing equivalent reliability.

V. Concluding Remarks

Do you know what characteristics of your current or planned communications system contribute to continuing increases in cost efficiency? Do you know what aspects constrain utility? How will these variables and relationships change with developing technology? The risk in developing new communications facilities is in not knowing and undestanding the answers to those questions.

Relative to the popular objective of developing "fully integrated" communications systems, be forewarned that the blind pursuit of that windmill (as Don Quixote) might lead to excessive costs and less than satifactory performance. Over the short-term, we will see the integration of voice oriented systems with some degree of data services - and the integration of data services with some degree of video service. Over the long-term, we will see the total integration of voice, data, and video services on one communications utility.

Total capital and operating expenditures for communications services will increase dramatically over the next 10 years. Although unit costs (e. g. per connection, per connect time unit, per packet, etc.) for communications will decrease rapidly, total costs will increase because of the exponential rise in demand.

Are you evaluating your current communications capabilities and opportunities? Perhaps the most significant risks belong to those who are not yet aware of the problems inherent in old communications infrastructures relative to current and coming demand. Their risk will be realized in terms of lost competitiveness.

A FULLY INTEGRATED, ON-LINE FINANCIAL ACCOUNTING SYSTEM

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ABSTRACT

Southeastern Louisiana University realized the need to replace a limited financial system in order to improve management of its financial resources. The new Financial Information System (FIS) efficiently automates recording, classifying and summarizing accounting data in an on-line environment. FIS is truly an on-line system since all transactions are immediately posted and balanced as they are entered. Due to the importance of accurate, up-to-date data, much attention was given to backup, recovery and audit trails. The system is designed to be integrated with all other systems at Southeastern, and is based on NACUBO standards. FIS components include purchase requisitions, purchase orders, accounts payable, general ledger and budget management. A subset of transactions can be viewed on-line which limits the need for detailed reports. Department heads can, on-line, monitor account balances and track purchase orders, requisitions and similar transactions. A flexible report generator is available to produce standard reports as well as to design special reports as needed. FIS has significantly improved the university's capability to manage its financial resources.

PREFACE

In July, 1984, Southeastern Louisiana University implemented a fully integrated on-line Financial Accounting System. As is widely known, computers have been used for sometime to perform accounting functions. In recent years, there has been a trend toward on-line systems and integration of various functions to form a comprehensive system. This paper will discuss Southeastern's implementation of an on-line Financial Accounting System with emphasis on what is believed to be the distinguishing features of the system.

FIS (Financial Information System) consists of only five programs. These five programs are all that are necessary to perform nearly every traditional accounting function. There is an on-line program for posting, updating of files, on-line inquiry and a variety of other features. A comprehensive, "user friendly" report generator is available to produce all reports including routine reports as well as one time, ad hoc reports. Two algorithmic type programs were written to perform such functions as balance verification, month end and year end. Additionally, there is a check writing program. These five programs permit full integration of all accounting functions and interaction with all other university systems including Student Records, Registration and Payroll/Personnel. All FIS programs are run on-line and are completely menu driven. The system is easily modified to include additional major functions or to enhance existing functions. Finally, FIS was designed to include all basic functions of the old system, as well as to provide a foundation for future development.

This paper is organized into four major parts. The first part includes a brief overview of the system, some information about Southeastern, the effort necessary to develop the system and how this paper is organized. The second part is a functional description of the system from the Controller's point of view. It will include a discussion of the new system in contrast to the old system, and will provide a discussion of the major functions of the system. Additionally, part two will describe the parallel operation of the old system to the new system and the conversion process relating to the new system. The next part covers technical aspects of the system relative to system design, file structure and data organization. It will also discuss how integration was achieved relative to the various accounting components as well as with other systems at Southeastern. The last part is a summary of key features of the system, what the university plans to do next and how additional information about FIS can be obtained.

ABOUT SOUTHEASTERN LOUISIANA UNIVERSITY

Southeastern Louisiana University is located in the beautiful, picturesque Florida Parishes of southern Louisiana in the city of Hammond. The university has a fall semester enrollment of approximately 9,100 students. Southeastern is a state supported institution and teaches both undergraduate and graduate courses. The university has a traditional college campus with facilities for housing and student activities which include major sports such as football, baseball and basketball. The annual budget is approximately $32,000,000 which consists of funds from student tuition, state appropriations and revenue generating auxiliary services. The university's general accounting requirements are similar to those of any state supported institution.

The university has a Honeywell DPS 8/52C dual processor computer. The computer runs CP-6 which is a real memory operating system. The system has 24 megabytes of main memory, 4 billion bytes of on-line disk storage and supports 200 on-line CRT terminals, as well as other devices including remote printers and optical scanning equipment. The Honeywell computer is used for both administrative and academic functions. All systems at the university are completely on-line although a few batch jobs, such as report generators, are run to produce large volume reports.

IMPLEMENTATION OF THE SYSTEM

The implementation of Southeastern's fully integrated on-line financial system was necessary to replace a very outdated, special purpose electronic accounting system. The design of FIS began in earnest in February, 1984. Programming began around April, 1984. The running system was implemented in July, 1984 and is now running parallel to the old system. Only two programmers were involved in writing the system. The Director of Computing Services served in the capacity of project leader due to the absence of a financial systems project leader. Currently, the system is fully operational and all functions and features originally planned for the first stage of the system's development have been successfully implemented. This first stage was simply to replace the old accounting system and provide a foundation for further development.

NEW VERSUS OLD SYSTEM

The Financial Information System was designed to replace the "Stewardship and Management Accounting System" which runs on a NCR-499. This system was developed by NCR in the late 1960's and early 1970's for implementation on a NCR Century System. NCR was contracted to convert this system to a NCR-499. The conversion was completed in July, 1978. To convert the system to the NCR-499 meant the elimination of a number of management accounting functions in the original Century version of the system. The NCR-499 version of the system was an improvement over the previous system, a Burroughs posting machine. However, the information provided to the middle manager still was not adequate to properly manage their resources.

FIS was designed to be implemented in multiple phases with emphasis here on Phase I. Phase I was to convert the functions that existed on the NCR-499 to the university's main frame and to build a solid foundation for future expansion. While the end results have not changed drastically, the means to reach the results have. The main advantage is that financial transactions may be entered through multiple work-stations. Basically, any ADDS 60 terminal may be used to enter financial information. Given this fact additional controls had to be implemented to limit a user's access to the system's updating functions. Managers who have access to ADDS 60 terminals are able to review the most current information for an account, a department or a project. In times past this information was only provided to departments via a hard copy on a monthly basis.

MAJOR ACCOUNTING FUNCTIONS

The majority of the transactions processed deal with the expenditure side of the ledger. This is where the greatest emphasis was placed in system design due to the need for budgetary control. A step by step process follows.

The old system was designed to begin the encumbrance process with the posting of purchase orders and had no control features -- only recording functions. The FIS system has budgetary control features which begin at the requisitioning stage. Before the Purchasing Office processes a requisition for goods or services, the system verifies that the department has adequate funding in that budget category.

Once the Purchasing Office has performed its function and a purchase order is issued, the purchase order is then entered into the system. Purchase orders may be posted against a requisition previously established or as the beginning of the encumbrance process. If the purchase order is established against a requisition, the requisition is automatically liquidated and the purchase order established. If there is a difference between the amount of the original requisition and the purchase order, the remaining budget is adjusted to reflect the difference. When a purchase order is established without a prior requisition an adjustment is made to the remaining budget only for the amount of the purchase order. Since the issuance of a purchase order is the beginning of the accounting process for the university, all entries must balance. The system will not let an operator exit to another routine until all the entries are in balance.

After all documents are received to support a payment, the accounts payable or the manual check routine is used to record transactions. These two routines are the same except the accounts payable function is used to set up items to have the computer generate checks while the manual check routine is used to record the transaction after the check has been written. The accounts payable posting routines are used for payments against purchase orders, payments against requisitions and payments of miscellaneous items.

When a payment is set up or paid against an established purchase order, a debit is entered into the system by the operator and the computer generates an offsetting entry to the encumbrance account for the amount of the payment. If the payment is a final payment against the purchase order and the amount of that payment does not agree with the balance of the purchase order, an additional offsetting entry is created to bring the encumbrance account to a zero balance. The system also makes appropriate adjustments to the remaining budget field for the above transactions. When a payment is set up or paid against an established requisition, a debit is entered into the system by the operator and the computer generates a memo entry. The memo entry is used in tracking all activity for a specific requisition which may be used in the future when a purchasing system is implemented.

Finally, there is an accounts payable option which handles all miscellaneous disbursements. These include such items as student refunds, travel advances, and expense accounts. This function is used to set up a payment for the transaction entered and debits the account entered. If this function is used in the manual check mode, a check will not be written, but the various records will be updated.

The accounts receivable and income recording functions begin with the creation of an account for an individual through a charge slip. This allows the posting of the debits and credits from the source document to the accounts receivable account and to the corresponding income accounts. Since the accounts receivable is a controlled account, the vendor number for an individual or company must be entered. This allows the university to keep the detailed transactions on an entity until the account is paid in full. Future plans for this system, as it relates to the accounts receivable function, are: (1) Allowing the computer to generate the supporting documents such as charge slips and credit memos from the entries entered into the system instead of posting the transactions from the supporting documents and (2) generating accounts receivable billing notices to students. This can be easily accomplished because detailed transactions are carried forward on individuals who have outstanding obligations to the university until their accounts are paid in full.

The cash receipt function allows the cashier to enter individual receipts as transactions occur. The old system, with its limited disk space, only allowed the posting of summary information on a day-to-day basis. The posting function is similar to that of the accounts receivable posting routine. The purpose of entering detailed transactions for cash receipts was to permit greater flexibility for report generation. It also provides the detailed information needed to create a cash flow model from the cash receipts. This portion of the system will be developed in such a way that cash flow information may be received in summary form or detailed transaction form or any variation of the two. This also gives the capability of excluding certain transactions which may skew a cash flow analysis from one reporting period to the next.

With greater emphasis on budgetary control and because expenditures cannot be made until funds are in a budget category, a system of budget transfers had to be developed. Budget adjustments are made by entering the account code, department number and the amount of increase or decrease to that budget category. Since budget adjustments are processed after the budget is adopted, the system does not allow such transactions to be entered unless they are in balance.

A general posting function had to be designed with great flexibility to provide posting of an array of transactions of which the most complicated is transactions between funds. To this point, all transactions posted had to be entered and balanced by fund before transactions to a different fund could be entered. The general posting routine allows the posting of transactions within and between funds. However, before the routine can be exited, the entries posted must balance in total and by individual funds. If they do not, the system identifies the funds that are out of balance which provides ease in determining which transactions were posted incorrectly. In the past, checks had to be written from one fund to another to facilitate such a transaction. Now, funds can be easily transferred from one fund to another using this posting routine.

MAJOR ON-LINE DISPLAY FUNCTIONS

To properly manage resources, timely information must be available to management. In the past, managers received monthly printouts of their department's activities. Monthly reports were produced and distributed approximately ten to fifteen days into the following month, creating problems for budget heads attempting to manage their areas with stale information. There was also a long delay from the time a department submitted a requisition for supplies, equipment or services to the time the encumbrance was reflected on the university's books. With FIS, a department may review the status of its accounts at any time via a CRT or hard copy printout. The following on-line display options are provided for each department's use:

1. ACCOUNT SUMMARY

   This option provides a summary display of budgeting information as well as balances on outstanding requisitions, purchase orders and any debits or credits made against that account during the fiscal year.

2. ACCOUNT SUMMARY WITH DETAIL

   This option provides summary information as described above plus transactions involving outstanding requisitions and purchase orders as well as transactions affecting the account balances that occurred during the current month.

3. OUTSTANDING PURCHASE ORDERS

   All outstanding orders for a department or an account can be displayed with this function. This could prompt department heads to follow up on outstanding purchase orders that are a number of days old.

4. OUTSTANDING REQUISITIONS

   This option provides a listing of all requisitions which have been submitted for a department or account but have not been paid or for which a purchase order has not yet been issued.

5. LIST OF ACCOUNTS FOR A DEPARTMENT

   This provides a list of all accounts with selected budget and expenditure information. A total view of a department's budget and expenditure activity is provided at a glance as opposed to account by account basis.

6. LIST OF TRANSACTIONS FOR A CONTROL

   As mentioned earlier, some accounts require control number or vendor numbers to be entered with each transaction. Staff members have the capability of displaying a list of all transactions for a particular vendor or student.

7. LIST TRANSACTIONS FOR A REFERENCE

   To provide greater flexibility in the system, a unique referencing routine was developed to make it easy to extract information on-line. This function allows the display of transactions for a specific reference.

One of the most important features of this portion of the system is that the information displayed on-line is the most current information through the last transaction posted.

CONVERSION

To minimize the conversion effort, FIS was implemented at the beginning of the university's fiscal year. The largest task during conversion was establishing a comprehensive chart of accounts which would allow optimal use of the on-line report generator. The next step was to build the various files needed by the system such as the vendor file, the departmental data file and the chart of accounts. By starting at the beginning of a fiscal year only the accounts with outstanding balances for the prior fiscal year had to be established. To insure the integrity of the new system a period of approximately six months was established for parallel operations of the two systems.

FUTURE

A number of items were mentioned earlier which will be implemented in the future. In addition to those are the following:

1. The interface with other systems developed on campus for inquiry and posting.

2. The development of a purchasing system to be interfaced with FIS.

3. A function to reconcile monthly bank statements.

4. A costing system for the university.

The old system will be completely phased out during the next couple of months. The new system will be enhanced as needed and as the university gains a greater working knowledge of FIS.

TECHNICAL DESCRIPTION

Several major technical objectives and concepts were considered in the design of FIS. First, it was considered very important to efficiently automate the recording of financial data in a truly on-line environment. The availability of up-to-date and accurate financial information for all levels of management has become essential. A truly on-line system requires that all files be updated immediately as transactions are entered. Implementation of the system on the university's main frame computer was necessary if information was to be made available to departments throughout the university, and if FIS was to be interfaced on-line with other university systems. The second objective was to insure the same functionality that was provided by the old stand alone system. The third objective was to design the financial system in such a manner that all accounting functions could be fully integrated. Otherwise, more programs would have to be written, operation would be more complicated and eventually the end result would probably be an undesirable, fragmented system. Fewer programs and a fully integrated system should require less effort and time to add other functions or to make enhancements. The financial system was designed to permit interfacing with all other university systems including Student Records, Inventory, Payroll/Personnel and Alumni. This should reduce the duplication of data throughout the organization. For instance, if it is necessary to write a check to an employee, using the financial system, the name and address can be obtained directly from the Payroll/Personnel System. The last, but perhaps the most important objective, was to provide a good foundation for future development and enhancements.

SYSTEM DESIGN PHILOSOPHY

At this point it should be helpful to briefly describe Southeastern's system design philosophy. All systems at the university employ the same basic design and are based on two standard programs. These two programs consist of the On-line Program and the Report Generator. Additionally, all systems have the same basic files which are the master file, the related data master, the journal file, the system file and the altered records file. The two standard programs comprise from 40% to 80% of all programming for a system, depending on the particular system. This approach was taken to reduce the time required to implement a new system by reducing the duplication of programming effort and to insure a common system architecture that would facilitate on-line interface between various systems. Currently, all six major systems at Southeastern use this approach.

The standard on-line program is referred to as the "frame". The "frame" is a common handler for terminal communication, menus and screens. The standard screen routine handles processing, editing, and displaying of data entered. In addition, the frame handles file I-O and journalizing of data entered on-line. A variety of standard utility subroutines, such as message handling, parsing of data and handling of print queues, are part of the frame.

The report generator is a powerful and versatile tool for extracting, summarizing, organizing and presenting the information in a data base. Reports can be simple listings or complex reports. Users can specify multiple breaks and subtotals. The report generator was developed to permit users to design, submit and run their own reports. Standard reports are those that are run routinely and initially require being set up by a programmer. For example, some accounting reports are detailed and complicated and it is necessary for a programmer to write specialized COBOL instructions to produce the report. Ad hoc type reports may be designed and run by the user as needed. For example, a transaction list may be needed for a particular account which is not one of the standard reports.

There are five standard files for each system. The Master File, Related Data Master and System File are the three most important ones. The Master File contains the primary data for a system. In the case of FIS, the Master File contains the various accounting transactions which are posted or generated. The Related Data Master contains information other than primary data which is directly related to that system. The Master Accounts records, vendor records and purchase order reference records are examples of data contained in the related data master for FIS. The System File defines the data base. It is like a data dictionary and contains record description information such as length, key size and organization. The dictionary also contains a complete description on each data element. For example, the account number would be defined in terms of its size, record position, data classification, and audit requirements. The System File also contains screens, user menus and information as to which systems a user has access. All systems at Southeastern use the same System File.

FIS DESIGN

The design of the financial system required only six files and five programs. The programs include an on-line program, a check writer, an algorithmic program, a month end program and a report generator. The on-line program is completely menu driven and processes transactions and the updating of related files. A variety of screens and special functions are available to users for entering and displaying data. The check writer was specifically developed to print checks, and allows the controller to run and print checks as desired. This program also generates transactions and updates existing transactions with the check number and a batch number. The algorithmic program has several functions. One function permits verifying the balance of all transactions on file as well as verifying the balance of the master chart of accounts file. Another function permits printing of a cash requirements and accounts payable list. This list allows the controller to verify the cash in the bank as compared to the cash needed to write the checks. It also list all vendors to be paid along with detail transactions. This information can be used for postponing payment if desired. Year end is also a function of the algorithmic program. This function clears all data related to the past year and carries forward any information as needed. The month end program updates balance forward fields in the Master Accounts File, deletes old transactions and flags transactions carried forward as prior month transactions. There are other procedures that accompany the month end program which update the transaction history file, rebuild the index file and produce monthly reports. The report generator permits the controller to run standard reports or to design ad hoc type reports as needed. Reports can be run on-line or in batch.

The financial system, like all other systems at the university, was designed to have two main files. One file, the master file, contains information pertaining to all transactions for the financial system. The related data master contains information such as master chart of accounts records, account code records, control records (names and addresses), purchase order references and requisition references. In addition to these files, there are several other files that are important to the system which include the system file, index file and history file. The system file is like a data dictionary and is used to define the Financial System. The index file provides a variety of ways to access a subset of data on-line. There is also a history file which contains a cumulative, year-to-date set of transactions.

All systems at Southeastern Louisiana University are based on a standard program referred to as the "frame." In addition to the "frame", FIS contains "special routines" which are for posting transactions, displaying a subset of transactions and setting up budgets. The various posting functions in the on-line program use a common set of routines. These routines validate the data entered, handle error messages, provide "help" information and format transactions entered in the master file. Actually, there are only two major differences between the various posting functions. The first difference is how the master chart of accounts is updated in terms of which fields are updated. The second difference relates to the generation of transactions by the computer depending upon the particular posting function. In some posting routines, transaction(s) are automatically generated to offset the entry that was posted. As discussed earlier there are several functions available to display a subset of transactions on-line. A Vice President or Department Head can use these on-line display functions as a quick means to obtain reliable, up-to-date financial information concerning their areas of responsibility.

There is always the possibility of a system crash due to a variety of reasons such as hardware failure, program error or loss of power. Since such problems cannot be totally eliminated the financial system was designed to include a "fix" routine. This routine allows the controller to "fix" the current balances in the master chart of accounts or to enter one sided posting entries. The system automatically generates detail transactions for any "fix" action taken in order to provide a complete audit trail. These transactions are considered as regular transactions for such functions as reporting, month end and checking system balancing.

SUMMARY

Because of space limitations, many details of the system have been necessarily omitted. Therefore, only the key elements of the system were described. The Financial Information System is a completely on-line system, all accounting functions are fully integrated and the system permits on-line interface with all other systems at Southeastern. FIS is based on the same common system design as all other systems at the University. The initial version of FIS was completely designed, programmed and placed into production in less than five months by a team of only two programmers and a project leader.

Southeastern Louisiana University's fully integrated, on-line Financial Information System implemented in July, 1984, has been very successful. The objective of converting the system from an outdated stand alone accounting machine to a multipurpose main frame computer system has been achieved while at the same time providing for full integration. With a minimum of personnel, nearly any new accounting function or feature can be added in only a few short weeks. For instance, the system currently does not have a billing function. Yet, this function could be totally programmed, tested and implemented in less than two months. This is possible since all the building blocks are already in place. Thus, it would just be a matter of adding a few reports and a couple of functions within an existing framework. Perhaps the most important aspect of FIS is the ease of modifying the system to include additional functions and features.

Personal Computers: Is It Really Independence Day At Last?

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ABSTRACT

Since the beginning of computing, end users have had to depend on the provision of centralized services to fulfill their ever-increasing computing needs. The advent and proliferation of personal computers promises an end to that dependency, but how well does reality match the promise? Is there, in fact, reason to believe that personal computing may even increase the dependency on centralized services?

The benefits of personal computing are already all around us on our campuses. But there are also increasing problems for end users trying to go their own way with all of this. The choices of retailer, hardware vendor, software vendor and configuration are becoming almost overwhelming. Keeping up with the literature to stay well-informed is almost a full-time task. Learning the basics of good computing, such as disk backups, security, structure, and vendor service responsibilities, turns out to be a much larger-than-expected job. Programming, even in a "fourth generation" command language is still programming and more difficult than we've been led to believe. Using the micro to access centrally-stored data can be a frustrating business, and brings with it its own set of issues about campus-wide compatibility, database administration, and data networking. Where does the end user turn for help and support? Where else but to the central Computer Services department, whose very purpose it is to assist with computing issues?

The "personal" in "personal computing" should not mean alone, isolated, unsupported, and completely decentralized. Rather, the point of view of this paper, as written by an end user and a computer professional, is that personal computing can help us strike a balance between what users can do for themselves to gain control and responsibility and what computer people can do to support that.

Introduction

The University of Hartford is an independent university located in suburban West Hartford, Connecticut. Our enrollment is approximately 8,000 students split equally between full-time and part-time status. The University consists of eight semi-autonomous colleges and schools.

Administrative computing is done on an IBM 4341, which is accessed by end users through about 75 terminals. In addition, there are approximately 86 microcomputers being used by administrators and their staffs.

The following scenario is presented tounge-in-cheek. We used to take it seriously, but then again, that was in our youth. This material is intended for mature audiences and may contain statements which are offensive to users and data processing professionals alike. We are non-discriminatory critics. The scenario you are about to hear is based on fact, although the names have been changed to protect the guilty. Any similarity between the problems presented herein and your problems, present, past, or looming ahead, is more than coincidental.

In the Beginning

Three years ago, being one of the primary computer users on campus, I experienced very little frustration with my Computer Services Department. They were immersed in trying to hold together information systems which were created in the late sixties. These systems (I am being overly generous in my use of the word "systems" here) were outdated, misunderstood, poorly documented, and, in general, about as useful as a screen door in a submarine. Almost all of the programs were written in NEAT 3, a language about as common as Sanskrit or Classical Greek. They executed on an electrically powered abacus. We didn't change much because we didn't know how.

Despite the general state of disarray, I felt no frustration. These systems were bad systems. We all knew they were useless and we expected very little from them and received even less. They continued to function because our demands were few, our expectations were modest, and our luck was holding out.

Two and a half years ago, we decided that we would embark on a bold new path to upgrade our information systems. We faced the classical choice: build on what we already had or start over again. An intense evaluation of these alternatives was initiated. Eleven minutes later we decided to start from the beginning, thus completing our decision-making process in this area. We opted to buy "state of the art" systems capable of performing far beyond every known standard of the industry. The rationale for following this course of action was that finally we would be able to have all the information we wanted and maybe even some of the information we needed. And thus the Holy Crusade was begun.

Thirty months later, 2 million dollars poorer, and ten years older, I find myself frustrated, disillusioned, and rapidly losing patience. We now have a fine data base and a really spiffy online transaction processing system. All major functional areas have successfully been automated; that is, of course, assuming that the University doesn't want to get out anything that they have put in.

The really frustrating part is knowing that we have all the data. The really damaging part is that my boss knows that we have all the data. You know, he is a funny guy. He just can't seem to understand how it can be that we have spent 2 million dollars, two and a half years, and thousands of man hours and still can't provide the information he wants when he wants it. The man just can't seem to take a joke.

Every time I need something, I find myself trying to negotiate a series of roadblocks thrown up by my Computer Services staff. Can you believe it, they want me to justify my request! What kind of service orientation is this? It's like taking your car to the gas station to have the oil changed and the attendant wants to know why. Strange group these data processors be. In any case, the typical request gets processed as follows:

1. A memo outlining the request is prepared and forwarded to Computer Services.

2. Two weeks later, my phone rings and the guy on the other end thanks me for my memo and says good-bye. I assume something will happen.

3. Three weeks later, he and I discuss it while waiting in line at the bank to cash our paychecks. It's a good discussion.

4. The following week, an analyst calls me to tell me that analysis is about to begin. About the same time, my boss, who requested the information, makes a bad decision because he couldn't wait any longer for the information he needed.

5. Week Six: analysis begins. Unfortunately, I have by then forgotten what it was that I was trying to do but that's okay because the analyst tells me she knows what I need and that work will begin immediately.

6. Week Eight: the analyst and I talk about the project in the bank line. Unfortunately, I didn't know we were talking about the same project.

7. Week Ten: I go to the farewell party for the analyst who tells me she has gotten a 40% increase in salary from her new employer.

8. Week Twelve: the request is placed in priority sequence by a guy using a ouija board.

9. Week Fifteen: the semester ends and my boss asks me the same question he asked me fifteen weeks ago. Sometimes even he remembers that he asked the question before.

10. We begin again. Users have a name for this process. We call it Trivial Pursuit.

About twice each year, we convene a general court of inquiry to determine why so little is available. We get a variety of creative answers like:

-- The demand is too high; you will have to adjust your needs.

-- The staff is too small; we will have to hire more programmers.

-- These new systems are awfully complex; we shouldn't monkey around with them too much. (Interestingly enough, this last reason is the very same one we used to hear when we had the old systems.)

Frankly, I am getting very tired of having this "institutional resource" unavailable to me. The quality of response is poor and my ability to manage is severely constrained because I am forced to rely upon others for vital services. Given this scenario, it is easy to see why I am now demanding a personal computer: my own little piece of the rock. Working through people hasn't proven to be very satisfactory, so I'll try another approach; I'll work around them.

After all, I'm sure that if I have my own computer, I'll be able to answer all those tough questions my boss asks. I'll be able to do very sophisticated data analyses, flawless word processing (even though I can't type), and be able to work at odd hours like 9 to 5 when our big computer is busy handling the online stuff. Why not; I've got lots of money in my own budget and it will fit right here in my office. It will always be available and since I won't be using an analyst anymore, I can avoid going to farewell parties and contributing toward the purchase of Cross Pen and Pencil Sets for people going to jobs which pay twice as much as mine.

This stuff really isn't all that difficult. Why, this week alone, seven different salespeople have dropped by just to tell me how easy and inexpensive this all is. A couple of them had extras in the trunk of their car. Why shouldn't I pop for it?

The View from the Central Facility

I want to thank my colleague for his thoughtful and cogent analysis, but I feel the need to refresh his memory on a few key points. The view from Computer Services doesn't quite correspond to what we've heard so far.

There is no question that the old systems were obsolete, cumbersome, and just generally awful. It was, in fact, a classical case of nickel-and-diming your way to management information systems. So we were as happy as all of the users were to embark on a new major upgrading project, although we began to get just a little worried when it took more than a year for the institution to decide just what it was it wanted to do next. But clear heads fortunately prevailed, and the University finally decided to make its move.

A state of euphoria took over, and a grand new partnership was formed among Computer Services, users, faculty advisors, and senior administration. What I didn't realize at the time was that this was like going into partnership with Ali Baba and his Forty Thieves.

Thirty months later, Computer Services accomplished what our colleagues at other institutions and several consultants said could not be done:

-- We installed four major online, database systems: a student system, a financial system, an accounts receivable system and a payroll-personnel system.

-- We converted from NCR to IBM equipment.

-- We built and moved into a new data center.

-- We installed a new private telephone system.

-- We made a significant upgrade to the academic computing environment at the very same time.

And all of this with no increase in staff.

But just when we were beginning to think that we should be lauded and applauded for our accomplishments, what we heard resounding through the halls of the University was: "But what have you done for me lately?"

Instead of stemming the tide of service requests, as we had expected the new systems to do, what happened was the reverse. We began to be deluged with requests for every conceivable need, from birthday geeting card labels for people born before the year 1900 through a collection system for the Bursar's Office (it seems they forgot that little piece when they went through the specifications for their system).

Of course, being sensible people, we established a structure to manage the demand for services. Let me tell you about our Administrative Computer Users Group. These people began in good faith at the beginning of the project, meeting often to monitor progress, to resolve contention, and to keep everyone informed of all of the great strides in information systems being made by the institution. However, the structure began to show its first cracks during their second meeting, when asked to make a firm decision. Any decision. For instance, how many terminals should each user office be allocated? Where should the limited supply of online printers be located? What kind of doughnuts should they serve at each meeting? Which Vice President does this Committee report to?

The crack grew wider when asked to resolve a serious issue like the conflict between production schedules for payroll checks and financial aid award letters. At this point, they promptly decided to adjourn. Computer Services, left with this dilemma, worked at full staff through the weekend to get both requests done, but "what have you done for me lately?" again echoed in our ears.

As the contention for resources grew, the meetings correspondingly grew less frequent, until they finally came to their first unanimous decision: to stop meeting altogether. Of course, this left Computer Services with four different user groups to meet with regularly, none of whom would talk with each other, except in the bank lines.

And so we found ourselves in the midst of a classic situation. There were lots and lots of users, but like most service departments, we had too few resources to accommodate every request in a timely fashion. The department's work queues, in every area from programming to documentation to training to adding additional terminals, was long and growing longer each day. The programming backlog, for instance, was right about at the industry average, that is, about two and a half years. And that represented just the work that had actually been requested; there was also a great deal of latent, undisclosed demand for services, from users who had not yet formally expressed what they wanted or needed.

Even though all the computer people were working very hard, it is easy to see why users became frustrated. The department couldn't respond to individuals as quickly as it wanted, because it had to attend, in a responsible way, to the whole campus. This was clearly setting the stage for users to take control into their own hands, and we were torn between letting them do that, because it would take some of the demand off Computer Services, and keeping them from doing it, because it was almost certain that the users would eventually get themselves into trouble.

At the same time, we believed that it would be good for our users to be more independent. While it is nice to feel needed, the whole direction of computing is to have more end-user responsibility and involvement, and that is clearly the right direction. Perhaps unlike many institutions, our computer people wanted to support that direction, but they also wanted to do it in a careful, planned way, fully thought-out and as low risk as possible. The problem was that the planning process was going to take time, and it wasn't clear that we had that time available.

I knew that by now, computer salesmen were regularly visiting the users, and there was a serious question about whether anyone in Computer Services ought to worry about that. Certainly many user departments had enough money in their budgets to buy at least microcomputers and some software, but did they really know what they were getting into?

And Then I Saw the Light

Letting the users get themselves into trouble wasn't really a problem. We were already in trouble. Absolutely critical components of each system were missing and we were unable to provide even basic data reporting services. Micros appeared to be the light at the end of the tunnel.

I thought I would go slowly on purchasing a micro; after all, I had another fifteen weeks before my boss asked any more questions. Consequently, I decided to place an order for the Business Information Management Basic Organizer system, Model YNLTM. For those of you who don't know this device, it is commonly referred to as a BIMBO and the model identification YNLTM stands for "You'll Never Learn This Machine". This device is manufactured by the Chargem and Dodgem Microcomputer Company and can be purchased for a limited time only by dialing 1-800-711-DODGE. And how much would you pay for this device? But wait, Chargem and Dodgem will also include several chapters (nonconsecutive) from that new owner's guide entitled Troubleshooting the BIMBO and Other Small Electrical Appliances.

Well, I got my BIMBO last spring. It came in four boxes with assembly directions in four languages: French, Italian, Swahili, and Gaelic. I laid out all five components on the desk and immediately called the manufacturer to find out where all the wires were. It turned out that I hadn't ordered them. It was then that I learned that "ready to install" really didn't mean the same as "can be installed." But they told me not to worry, their service representative would leave in the morning to assist with the installation. I had no idea how long it took to walk to West Hartford, Connecticut from Managua. We did, however, finish installation three weeks after he arrived.

Then I began my training. I started with a three-day, $700 course in Personal Computing Management. It was a good course; the instructor told me so. Then I took a course in Lotus 1-2. It was supposed to be Lotus 1-2-3, but I opted for an incomplete when I found out that this product didn't work on the BIMBO/YNLTM. I needed to upgrade to the BIMBO/MENMB, which stands for More Expensive, Not Much Better.

After achieving the upgrade, I retook the Lotus course, followed by one on DBase II, SPSS Mini, and Telecommunications 1. After four months of intense training, I could play Flight Simulator (without hitting the Sears Tower) and Donkey Kong.

Now I was ready for the big time. I drafted the following memo to my friendly Computer Services staff:

> To Whom It May Concern (I didn't know who worked there anymore):
>
> Now that I have played with my BIMBO for a while, I am ready to start serious analysis of the student database. Please hook me up to the database, or, as an alternative, send the student data that I will need to do this.
>
> As always, call if you have any questions.
>
> Very sincerely,
> A Faithful User

From deep in the bowels of the building, I could hear laughter. Following it to its source, I found myself in the inner sanctum of the programming staff. Their faces were red and their cheeks were wet. It was then that I learned my third great lesson: sometimes you can't get there from here.

I have faced adversity before. I simply decided to key in all the data required to create my models. And key I did. I poured in hundreds of hours and was almost finished, when I found that for some reason, the third and fifth disks of my ten-disk set had scrambled data. I'm sure it's nothing I did. They were securely fastened to the side of my filing cabinet with magnets. They couldn't possibly have been damaged.

In any case, I recovered the data and finally produced a cross-tab of the student enrollment of the Fall 1963 term. About that time, I joined the Chargem and Dodgem Users Group and paid several thousand dollars for perpetual care of my BIMBO. Two weeks later, Chargem and Dodgem divested itself of its electronics division, and decided to concentrate its corporate efforts on the production of solar-powered vacuum cleaners.

Then my boss has the nerve to ask me how come I've spent twenty thousand dollars more, and still can't answer his question. You know, that man really can't take a joke. In the final analysis, instead of seeing the light at the end of the tunnel, we purchased ten more feet of tunnel. A most interesting phenomenon.

Back to the Central Facility

Yes, problems had indeed begun to appear by now, and the situation was growing a little more chaotic each day. Campus-wide planning efforts were being subverted by the very people who would benefit most, in the long run, from these efforts.

A glaring example of this was the attempt to put into action a process for downloading certain data from the mainframe database files to individual users, in order for the users to be able to manipulate data on a local level. Before this could be accomplished, it was discovered that most of the principal end-users-to-be of this strategy already had microcomputer equipment, but that they were almost completely incompatible with the mainframe and communications setup. Chargem and Dodgem had decided, of course, not to follow any known standard from any source whatsoever, but to create a new standard of their very own. Everything from protocols to disk storage devices would have to be adjusted to accommodate the downloading.

Then there was the problem of people all over campus issuing reports created from locally-held data which were in conflict with centrally-held data. Imagine producing HEGIS reports with two different sets of data, out of sync in both timing and accuracy. Not only were many users duplicating the data collection, processing, and reporting that was going on by the central facility, but the information itself never agreed!

Futhermore, we were beginning to have a problem with security. While it's relatively easy to control data access when all of the data and its associated processing is centralized in one place, it's not nearly as easy to do when they are spread all over the campus. Often, users who would otherwise go through elaborate precautions with respect to sensitive data shown on reports and kept in private filing cabinets were leaving floppy disks around all over the place. Our auditors began to look very askance (as only auditors can do) at our data security situation.

What we were heading towards was random, ad hoc, disorganized data processing. And then when Chargem and Dodgem stopped making BIMBOs, many of our users were left stranded, and could no longer get any kind of service, or spare parts, or updated software and documentation.

Summary

Having learned some things the hard way, we think we can help other institutions avoid similar pitfalls.

The goals of independent, end-user computing are basically right, but the process of achieving those goals needs to be a cooperative venture. We need a campus-wide outlook, which goes beyond the needs of individual user departments. The benefits can be huge, as long as planned distribution of processing, not total decentralization, is the end product.

The following is a set of guidelines we think may be helpful for managing microcomputers and distributed data processing on campus:

1. There should be a set of standards for hardware, regardless of who actually does the purchasing. The standards should be developed with both campus-wide compatibility and ease-of-use in mind, and should be adhered to by everyone at the institution. This does not have to mean that there is only a single vendor or hardware set-up for every user on campus, but rather, the standards can take the form of a "preferred configurations" list, which contains several options. This method gives users flexibility and choices to accommodate special needs, but still falls within general compatibility guidelines. There are currently over 200 microcomputer hardware manufacturers and literally thousands of different configurations available from them. A preferred configurations list will narrow down the choices to a manageable and supportable few.

2. There should be standards for software and for software development. Whether users buy or create their own programs, it should be such that the software is ultimately maintainable and well-documented. When a user purchases software, he or she should use the same rigorous criteria set that is used

for purchasing mainframe software, including structured code, regular and dependable service from the software supplier, and cost-effectiveness for the particular application.

3. Security and data management should be maintained by some central organization, so that the institution has some assurance that only the right people have access to the right information, and that sensitive data is treated in an appropriate fashion. The security controls are equally important whether they are for locally-held data or for data which is downloaded from the mainframe. Duplication of important institutional data and of software to process that data should be discouraged, so that the institution can report, both to inside and outside constituents, with information that is consistently and accurately held.

4. End user computing processes should be well-documented so that all users know how and when to back up their disks, how to keep local data secure, when it is appropriate to copy proprietary software and when it is not, how to obtain hardware service, how and why to maintain different versions of the same file of data, and so on.

5. There should be a document of understanding between the central facility service organization and end users, covering such things as system usage, equipment ownership, hardware changes, the use of central facilities in conjunction with microcomputers, system management controls, problem reporting, software acquisition and standards, data management, security, operations, and financial obligations. The more these sorts of things are spelled out in advance, the less chance there is later on of unmet or unrealistic expectations.

6. There should be an institutionally agreed-upon set of guidelines governing which applications can and should be implemented on a microcomputer.

7. While standards, policies and service level agreements can be formulated, a necessary ingredient for success is a satisfactory resolution of the control issue. Who controls the resource is not nearly as important as the establishment of a consensus that the control location is correct.

While some organizations may fear that the growth of microcomputers and end-user computing will erode the amount of responsibility that the central facility has had in the past, this fear is generally unfounded if the situation is handled in the right way. What is more likely to happen is that the responsibility will be of a different and better nature. The amount of support to end users is not going to diminish; it will, however, be a different kind of support, with a new emphasis on assistance-to-the-user, rather than doing-for-the-user.

The good news is that the use of personal computers can greatly enhance the central computer facility at the institution, while at the same time, provide a degree of service to end users which is far greater than that which was previously available. The key is to be engaged in a real partnership between the central computer facility and end users which balances the need to experiment and to be flexible with a structured and cost-effective approach.

The Macro/Micro Boom - Applications and Implications

R. E. Roberson
Systems Vice President for Computing
University of South Carolina

The University of South Carolina is both typical and atypical as far as Universities are perceived. USC has multiple campuses (nine), as many Universities have more than one campus. Being a University we have undergraduate and graduate programs in numerous areas and have schools of law, medicine and nursing, among others, as many Universities have. We have sought to implement technology in behalf of instruction, research and administrative needs. Where we may be somewhat atypical is the responsiblity for technology not only for the Columbia (main) Campus but the other eight campuses as well, is centered in the System Vice President's Office. This responsibility includes providing central main frame computer power - Amdahl V6-2, IBM 3081 D and VAX 11/780. It also includes consulting in software, hardware and communications; development of University-wide administrative applications; education in the form of short courses and video courses; support in graphics, office automation, systems and data base. This responsibility also includes procurement approval, budgeting and planning. Layered over this University obligation is the role of being a service bureau to over seventy state, county and local municipality users. (In many cases this involves the design and programming of applications). The responsibility includes the current installation of PBX's at our Coastal Carolina and Columbia campuses and next Summer we will do the same at our Spartanburg campus. Considering the aforementioned plus the fact that we have 190 staff and are involved in international development in such places as the Dominican Republic, that we had enough to pray over. Absolutely not-we decided to challenge the world of micro processors.

As we observed small volumes of purchases occurring, primarily for continuing education, teacher certification and as supplements to a computing science course, we did not get overly concerned. What impact did a few North Stars, Osbornes, Commodore Pets, Apples, TRS-80's etc. have on the bigger picture of computing in a large environment such as ours? While we were spending $50 - $100,000 on micro's our other expenditures were running in excess of $7 million. The people buying them knew what they wanted and seemed to make good use of the resource.

Then - 1982 - and the Macro-Micro Boom hit. The introduction of IBM products into the marketplace of micro's altered the information technology business. Large volume purchases, discounts and term contracts became a new way of life, along with the responsibility for ordering, billing, inventing, configurating, securing, testing, educating, consulting, communications, maintaining and assisting in the development of micro applications.

No longer was it just the single user or faculty member with a particular need, it was whole schools looking for word processing, offices seeing the opportunity for independent applications and of course, some people thinking if you did not have a micro you had your head in the sand.

Between October 1982 and December 1983 the University of South Carolina bought 1200 microprocessors from IBM. These were primarily PC's and XT's. Since January of 1984 until November 1, 1984 we have bought another 800 XT's, 3270 PC's, XT 370, PC Juniors, Portables and AT's. We expect to buy an additional 1000 IBM Micro's by July 1, 1985 and as many as 700 Apples (McIntosh and Lisa's), not to mention the 350 Digital Rainbows we installed in October 1984. This means we are expanding, including peripherals and software, approximately $6 million per year.

I do not want to leave the impression that $6 million worth of micro's are obtained for the University of South Carolina. Approximately one/fourth of that amount is for USC. The remaining three-fourths we procure and resell to other educational institutions within the State, under the auspices of term contracts, and for which we retain between 5 - 7% of the sale price.

Some of you are already calculating the fact that we are deriving about $300,000 plus a year from such sales. You are absolutely right and yet the support for microprocessors implications and applications exceed such funds.

Let me give you some examples:

1. Micro Processor Displays.

   To allow people seeking to obtain micro-processors, we provide at least one of each type in a demonstration facility.

   cost: $50,000 (one time)

2. Inventory Accounting System.

   Developed software to assist in the buying of inventory, accounting for items, recording of outstanding purchases, customer orders and billing. This changed the state accounting since retail procedures necessitated extending expense and revenue across fiscal year boundries.

   cost: $40,000 (one time)

3. Procurement/Sales Staff.

Three full time people have been employed to order equipment for inventory, develop end user requisitions, bill end users and follow-up on procurement shipments

cost: $65,000 (annual operating)

4. Educational Facilities.

Short courses and video courses are offered on various subjects. Members of the University staff and students are free to use both types of instructions.

cost: $30,000 (annual operating)

5. Maintenance/Security.

Maintenance is a billable item ($30.00) an hour, plus parts and a special contract for security equipment is in place.

(Anchor Pad)

Training - $18,000 (one time)

Support - $15,000 (operating after revenue)

6. Communications for Micros.

The use of micro's either as an attachment to controllers or shared logic processors and as access devices has resulted in the installation of a PBX at the main campus. Students will be able to access hosts from dorm rooms.

cost: $3.5 million over 5 years (one time)

$150,000 (operating)

7. Consulting for Micros.

The academic and administrative staffs have had to become authorities on classes of micro's and software and a library for reference by users has been put in place.

(Estimated calls per day - 200)

cost (estimated): $50,000 (operating)

8. Application Development.

In very special cases will we do stand alone application development: President's Speech File-Correspondence School-Small Business Office. What we have discovered is there will be widely used applications where micro code will be written for a number of users and which is generally used to front end an Administrative Data Base System.

For example:

Edits - submitted to batch application:

Student/Accounting data down loaded to a micro for access by an academic department or office.

Library Book Exchange Control

I do not want to leave the impression that we had all of this in mind when we embarked in force into the micro world. We did not know that a group of microprocessor specialists ($80,000 a year) would have to be put in place to support point 8, above, for example. We did not anticipate the procedural, consulting, security or educational needs where going to have to be any where near the magnitude.

It is my judgement that the infusion of micros has changed the very essense of technology.

We cannot be the caretakers of technology as we may have once seen ourselves. We no longer have that set of users reliant on computer applications, centrally supported, and a second set of users, with varying levels of sophistication, making use of centrally supported software packages.

We now have microprocessors in huge quantities, ranging in cost from $500 to $10,000 plus dollars. These processors can make use of software packages that are increasing in volume annually, at a rate that exceeds all the previous software in the world. And, this only represents marketed software, not individually developed and single user software. Such software is frequently delivered with bugs, lacking in documentation and beyond the resources in a data center, if for no other reason than time.

Computing in the micro world has created an army of people who have paid for software and hardware and in many cases have never or rarely used any computing previously. They expect the data center to be responsive to any and all problems they incur.

It is not possible.

The key to any kind of sanity and organized approach must become defined and identify coordinated levels of service.

Some of the ways we seek to assure performance have already been mentioned. Let me list them, plus a few others, in more precise terms.

1. Consulting/Application support for microprocessors will be limited to three (3) vendors:

   APPLE, DEC, IBM

   (This would only change if a substantial number of another vendor's micros were put in place).
2. Communications support (PBX) will be provided for BISYNC, ASYNC, 2780, 3780, ASCII and 3270 devices.

3. Catalogs of software available will be available. Technical resources to assist users will be provided, however, for limited and designated software.
4. Maintenance and security systems will be specified, bid and supported for the micros identified in point 1, above.
5. Application development will generally be done only on a multi-user basis.
6. Educational resources will be offered on general topics and on explicit subjects. The explicit subjects will be provided for the micros identified in point 1, above.
7. Any micro from any vender may be obtained with the understanding of the commitments specified, above.

The day may come when such positions may be altered. It appears to me that day is sometime off and will likely be deferred as the microprocessor environment matures. In the meantime decisions must be reached regarding how much can we do and do well and what must we not try to do for fear of not doing anything well.

In short, the micro world is a macro problem unless you use your resources in behalf of the maximum benefit to the largest number of users.

THE PERILS OF PROTOTYPING

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ABSTRACT

The use of an application prototype as a basis for system design is the current vogue, but the use of this tool must be controlled. It is all too easy to expend excessive time and resources on the prototype, only to find out that a large part of the investment is not salvageable. This paper discusses the University of Miami's experience with prototyping, covering two separate cases. In one case, the prototype was too detailed and resulted in significant waste. In a contrasting case, the prototype was kept intentionally superficial, until database design had been completed.

The University of Miami was chartered in 1925 by a group of citizens who felt that an institution of higher learning was a major need for the development of a relatively new community. The community could offer unique opportunities to develop inter-American studies, to conduct teaching and research programs in the scientific and technical problems of the tropics, and to further creative work in the arts and sciences.

An independent, nonsecterian and nonprofit institution of higher education, the University of Miami is situated in one of the great cosmopolitan areas of the United States. The Miami area is the connecting link between North America, the Caribbean, and Latin America. The University serves approximately 20,000 credit and non-credit students each year.

In May, 1983 the Information Systems, Planning, and Institutional Research organization, which supplies the University with information, and computing facilities and services needed by the University, embarked on a Long Range Information System Plan that took four calendar months and approximately four effort-years to complete. The plan was published and approved by the President and the Board of Trustees in October, 1983.

We are now concluding the first of an anticipated seven years under the ambitious Plan. Because of the aggressive nature of the endeavor, rapid methods of systems development were considered fundamental for sucess. The system development techniques included: very high-level languages, a system development methodology, and prototyping. As with many novel approaches, experience has identified several pitfalls to be avoided. This paper summarizes our experiences, and highlights some of the perils to avoid when using prototyping as a tool in rapid system development.

DEFINITION OF A PROTOTYPE

What is a prototype? According to Webster's Ninth Collegiate Dictionary, a prototype is defined as;

> "an original model on which something is patterned",

and

> "a first full-scale and usu. functional form of a new type or design of a construction (as an airplane)"

Our definition encompasses both of the above definitions as follows:

> "A working model of automated information processes which begins as a trivial representation, and evolves into a full-scale functional information system"

Practically speaking, a system prototype has the following characteristics:

- End-User view of the application
- Design and development aid
- Low resource investment

In other disciplines, such as engineering, prototyping has been common practice for years. As an example, in planning a bridge, models are built and stress tested before the actual erection is begun. Although such modeling is viewed as an innovative concept in system development, in truth, for a decade or more data processors have been inadvertently and awkwardly prototyping within the traditional life-cycle approach. Typically an application was developed with some degree of direct user involvement, but when the system was first put to use, discrepancies were quickly discovered between perceptions, expectations and reality. Through a flurry of post-implementation efforts, adjustments were made to the application. This was an example of unintended and costly prototyping.

User interaction and familiarity early in the design process is much more effective. With the advent of fourth-generation languages, a prototype can be created quickly and without a major investment in programming. This brings us to the next question. Who constructs the prototype? The users? The project manager? The systems analyst?

A systems analyst working with a knowledgeable user can create a demonstrable working model of an on-line system with relative ease. Following this, other users can then work with the model and suggest improvements. Changes can quickly and easily be incorporated into the system at this point. An iterative process, each subsequent improvement to the model is based on a working simulation, not on paper design documents which are notoriously difficult to interpret. As additional features are layered into the system, many flaws and omissions are discovered. The discovery might be that a function is difficult to use or does not flow properly. By exposing the design to scrutiny early in the design process, changes can be incorporated before any costly data base design or programming has taken place - not after the system is completed. When the user and designer are satisfied, then the application is ready for the labor intensive portions of the development project, without the spectre of major rework.

BENEFITS OF PROTOTYPING

The central benefits of prototyping are in determining the functional and data requirements of an application through user "hands-on" involvement before any code has actually been written. The prototype model should be executable and flexible enough to be easily changed. By exposing the problems of a system's design early, the typical eleventh-hour modifications that tend to be so costly can be minimized. Once completed, the prototype may form a skeleton for the production application. The benefits of the prototyping approach can be classified into the following categories: 1) specification, 2) discovery, and 3) salvageability.

SPECIFICATION

A major benefit of the prototype is that it aids in the specification phase of development. To be truly effective, the prototype should begin to take shape during the analysis phase of a development project, beginning with a "first draft" prototype based on preliminary user interviews and very brief, high-level functional analysis. Detailed processing specifications should intentionally be sketchy and incomplete until the user has had several opportunities to review and work with the prototype. The prototyping cycle should be reiterated until the model represents the ultimate design of the application. Estimating and controlling this phase is a management dilemma. Our experience shows that planning for two or three cycles, each with a finite duration has been effective.

Because the user is exposed to a functional model early in the development process, changes in requirements are quickly identified. Early changes mean modification to high level design instead of to detailed specifications, and therefore represent a savings in development cost. Properly managed, the prototype can represent many, but not all, aspects of the application design traditionally relegated to paper documentation.

DISCOVERY

Another benefit identified using prototyping techniques is based on the fact that a complete set of essential system requirements cannot be discovered until the user has had a opportunity to experiment with a working model of the system. The first edition of the prototype, even though satisfactory, will hardly ever function exactly as the user had hoped or expected. At this early stage, little effort has been invested in the prototype, and it can be easily modified to adjust to new requirements as discovered. As the iterative nature of prototyping continues, the workable prototype will accommodate new requirements easily, as they are discovered. Traditional methods of development are quite awkward when attempting to accommodate the rapid changes that are required during system development.

SALVAGEABILITY

Today's database tools and fourth generation languages, allow prototypes to be expanded into full-functioning production systems. Because of the ability to link together menus and screen forms, these programming efforts are minimized. The working prototype can be augmented with database design and detailed programming in order to produce a completely functional system.

Proceeding at a brisk pace, the prototype expands and is modified to accommodate newly discovered requirements. Specification details are recognized and incorporated into the prototype. This cumulative process continues throughout design, programming, and installation. When the system goes "live", it represents an advanced step in the evolution of the application from the "first-draft" prototype to the operating application system. A product of the user's imagination, it has been intimately reviewed and approved during each stage of development

Does prototyping ever stop? Not really. Even after a system is mature, it will continue to be improved through the prototyping of maintenance improvements.

RISKS OF PROTOTYPING

Prototyping is an exciting concept in system development. By the late 1980s' prototyping computer applications will likely become the predominate method for system development. Because prototyping has been a new concept for the University of Miami, some pitfalls have been identified that should be avoided. The overriding benefits of the approach lead us to recommend prototyping, with cautious management, as an integral part of any systems design process.

The most significant trouble areas have been: 1) Prototyping within a traditional methodology, 2) doing too much, and 3) user inattention. The following paragraphs discuss each of these risks.

PROTOTYPING WITHIN A TRADITIONAL METHODOLOGY

The University of Miami in implementing its Long Range Information System Plan adopted and installed a traditional system development methodology. In applying this development concept, a formal method of building software systems (using structured analysis and design tools, such as lengthy system analysis documents and structure charts), was put into place.

In our first attempt to incorporate prototyping into systems development, the prototype was introduced at the end of the design phase, and was constructed to validate the systems' specifications. This approach actually added steps to the development process and may have cost as much as 10% in total development time. The traditional methodology had guided the project team through a structured implementation pattern, whereas the prototyping approach could have eliminated several steps. In hindsight, much of the time spent in the classical process was wasted.

Can the new techniques of rapid prototyping be successfully merged into the framework of a traditional life-cycle approach? We believe it can - with some appropriate alterations of the traditional methods.

First, an analysis of the methodology should be performed before development begins. By conducting this review, many design steps and documentation tasks can be streamlined using the prototype. Initiating the prototype should be one of the first activities to take place in the development project. It then should be built upon throughout the remaining phases of the system life cycle. Ignore hard copy screen and report formats in the early design tasks. These can be helpful for final documentation and user guides, but a working model is much more useful during analysis and design. Next, forget about the requirement to have design specifications complete, approved, and signed-off before development begins. Final specifications can be derived from a user-approved prototype.

DOING TOO MUCH

Not only was the University of Miami using a new methodology, we were also using new development tools. Although the new high-level tools were ideal for prototyping, we were not familiar enough with the tools to avoid going into far too much detail with our first prototype. The result was a great deal of useless program code and an unimpressed user group.

The prototype should demonstrate the system context, showing where the system will obtain data and deliver information. The essential functions of the system must also be represented. And lastly, the database design derived from the essential functions must also be represented. Once these components have been included in the prototype, resist the temptation to continue prototype development.

If program code is written during prototyping, much of this work is likely to be obsoleted as changes occur in the model. Developers at this phase should be using screens and menus, not code. In later stages, when the model has stabilized, the prototype can be fortified with database navigation and control logic without fear of obsolescence.

The tendency to build excessive functionality into the model should be recognized and avoided by defining limitations on the level of simulation. This knowledge will come only through experience and familiarity with your prototyping tools.

USER INATTENTION

When the six concurrent development teams were formed at the University of Miami, users from each of the appropriate sponsoring areas were asked to sponsor full-time representatives on the projects. This would have been an ideal situation, if in all cases, knowledgeable users could have been released from their current responsibilities.

Because certain areas within the University could not release employees for as much as two years, some user "Information Analysts" were recruited from other sources to serve on the project teams. These new users typically had either generic experience in higher education, or had specific experience in an administrative area. All of the recruited analysts, however, were lacking in background specific to the University of Miami.

Because of this fact, the prototypes for some projects were developed by the technical members of those projects. Unfortunately, when the prototypes were presented to the using areas, they missed the mark. In typical fashion, the users had a poor view of what was wanted, but they recognized clearly what they did not want.

Project teams which developed very successful prototypes were fortunate enough to have active participation from user representatives with significant experience at the University. In some instances the Information Analysts had, for many years, been thinking about their information needs and system requirements. With a little instruction in our on-line mapping tools, these individuals were able to work at the terminal and paint ideal functional screens. Indeed this is a utopian situation, but it should be strived for in order to reduce the number of unsuccessful attempts by projects to satisfy the users via prototyping. In the optimum prototyping environment, the technical experts should be complemented with functional experts to develop the fundamentals of the application.

If rapid prototyping is really a more desirable way to develop applications and does not require great technical skills, then what is preventing users from participating more heavily in systems development? Very little. In some situations, more management commitment is needed to prompt the proper people to become involved with the project. Many users are unaware of the importance of their participation and commitment. Others, already suffering from overwork and understaffing, would simply rather data processing do the job for them. But now, with a new breed of sophisticated, computer-trained users coming into the picture, the outlook is optimistic.

SUMMARY

Do the benefits of prototyping outweigh the perils of prototyping? In our opinion, the answer is, unequivocably, Yes! With proper selection of prototyping tools and coordination with the system development process, prototyping is so vital to the successful project and promises to be such a cost effective method of system development, that organizations which do not gain a knowledge of the process now will become sluggish and unresponsive when contrasted with those that do.

The only true peril of prototyping is not using prototyping in system development at all.

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Great Applications

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INTEGRATING FOURTH-GENERATION TOOLS INTO AN EXPANDING APPLICATION DEVELOPMENT ENVIRONMENT

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ABSTRACT

Data processing managers are, with increasing frequency, considering fourth-generation languages as an effective solution to the applications backlog problem. These products which have most often been used as productivity aids for mainframe applications programmers, have generally produced a positive return on the investment required for their acquisition and start-up. The recent emergence of fourth-generation software for microcomputers, and end users who want to use this software to develop production applications, presents yet another situation for which the data center manager needs to perform a risk-benefit assessment.

In the past year Western Michigan University (WMU) has had the opportunity to acquire fourth-generation products for its mainframe and microcomputers. With these products WMU implemented applications employing three distinct types of programming personnel. Traditional applications programmers, Information Center specialists, and end users were individually or cooperatively responsible for developing several significant applications. This paper describes the experiences of WMU in combining "fourth-generation" languages with these diverse groups of individuals to produce useful applications.

Introduction

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In the past year Western Michigan University (WMU) has had the opportunity to acquire fourth-generation products for its mainframe and microcomputers. With these products WMU implemented applications employing three distinct types of programming personnel. Traditional applications programmers, Information Center specialists, and end users were individually or cooperatively responsible for developing several significant applications. This paper describes the experiences of WMU in combining fourth-generation languages with these diverse groups of individuals to produce useful applications.

Following a brief overview of fourth-generation tools and the expanding application development environment are discussions of the experiences of each of the three groups. Successes, failures and retrospective advice are presented on the merits and pitfalls of this experience.

Background

Western Michigan University is a state-supported institution serving approximately 18,000 full- and part-time students. The university offers graduate and undergraduate degree programs in the liberal arts and sciences, business, education, the health fields, and preprofessional disciplines.

Academic and administrative computing services are provided through separate centers. The Administrative Data Processing center supports routine administrative batch processing and an on-line network of 150 devices. In January of 1983 the university entered into a long-term computer resource management contract with Systems and Computer Technology (SCT).

During the next eighteen months the administrative center will complete the installation of an integrated student information system, expand by twenty-five percent the numbers of on-line users, and install significant hardware and operating system upgrades.

Fourth Generation Tools

There is today no concensus as to what constitutes a fourth-generation development tool. However for the present discussion certain characteristics will be accepted as lending fourth-generation quality to a product: Glover (1984); Goetz (1982); Martin (1982).

- o An integral data dictionary is essential.
- o The database can be created and modified easily.
- o Users view data as relational tables of columns and rows.
- o Available interactive retrieval and reporting facilities
- o Significantly less coding is required to accomplish the same task as would be required using a "high-level" language such as COBOL
- o Allows the user to direct the computer as to what needs to be done without specifying how to do it.

The last characteristic, while simplistic, summarizes the essential element that allows non-programmers to utilize these new tools to develop their own applications.

The mainframe products which have one or more of these characteristics that are available at WMU are EASYTRIEVE and EASYTRIEVE PLUS by Pansophic, Statistical Analysis System (SAS) by SAS Institute, and MANTIS by Cincom. Additionally, microcomputer products dBase II and III by Ashton-Tate and Microsoft's MULTIPLAN are included in WMU's fourth-generation tool kit.

The Expanding Application Development Environment

Several industry trends are combining to create conditions where the applications development process can be undertaken by persons not trained as programmers. End-users are rapidly becoming more literate in computing because of increased availability of microcomputers and are becoming more involved in computing activities . Martin (1982); Goetz (1982). Additionally, the industry is producing more sophisticated productivity tools which can be utilized by both professional and novice users to quickly develop a variety of applications.

At WMU these trends have manifested themselves in predictable ways. In the user community there is an increasing dependency on micro-computing and a growing need for a micro-mainframe link. Users are involved in the use of batch report writers and desire a similar tool for on-line access to the university data bases. In the data center there is a need for productivity tools, a better way to support ad hoc reporting requirements, and a more productive way to respond to the growing applications backlog.

In an effort to capitalize on these trends and to assess the viability of using fourth-generation tools for applications development, WMU created an Information/Decision Support Center. Moscovis (1983). Two of the centers primary goals were to: (1) provide users with the tools to access and explore their data in their own way and (2) to provide efficient response to ad hoc user requests for reports and information .

The Center embodies the concept of the expanding application development environment. The center is staffed by information specialists (non-programmers) to assist end users (non-programmers) in developing their own applications.

The sections which follow will discuss how productivity tools were introduced, applied and evaluated by a regular programming staff, an Information Center Specialist and an end user.

IMPACT ON DIFFERENT DEVELOPMENTAL ENVIRONMENTS

One of the clearest results of the use of fourth-generation tools has been a fundamental change in several application development environments. In fact, the evolution of new developmental environments turns out to be one of those results. The current emphasis on information centers and on end user computing are two environments which simply did not exist at any measurable level ten, or even five, years ago. The result of their creation is that in the area of administrative computing the definition of a computing user haschanged to include those individuals who now can invoke any of a variety of fourth generation tools on an ad hoc basis similar to the experience of academic computing users.

The following sections of this paper will focus on the impact of fourth generation tools on three developmental environments: the traditional environment, the "information specialist's" environment, and the end user environment. In each case, the following areas will be reviewed:

- o Nature of the users
- o Required training
- o User acceptance of fourth generation tools
- o Utility of fourth generation tools
- o Evaluation of a completed project

Traditional Environment

For purposes of discussion in this paper, computer users in the traditional development environment are applications progamming staffs. Academic backgrounds are typically two- and four-year degrees; professional training backgrounds usually with emphasis on application languages, data base, etc.

For this group, training in the use of a fourth generation tool can usually be accomplished in one to five days, depending on the complexity of the product. In addition to basic training, key issues for the traditional group include evaluation of the appropriate use of each kind of applications development tool (optimizing on development effort, end-product quality, and machine resource utilization), and on which of the university's policies such as security, ownership and privacy of data apply in a given situation.

Programmers usually view fourth generation tools as productivity aids for parts of some applications. Ad hoc reporting, prototyping, and the development of relatively unsophisticated applications are examples. A typical design might involve limited user data entry, appropriate editing, noncomplex data manipulation, and relatively straightforward screens and/or reports. The use of fourth generation tools for applications meeting these criteria tend to have a relatively high degree of programmer acceptance.

Shortly after acquiring MANTIS at WMU a senior programmer was assigned the task of using the product to develop an online data entry application which would interface with an existing inventory system. The project involved creating and integrating several functional screens which allowed menu selection of activity, data entry, data editing, query and browse capabilities. Additionally, all of these transactions utilized a TOTAL database.

The project resulted in a useful system which has become a vital part of the inventory operation at the university. The project was not without its flaws however.

The complexity of the task and unfamiliarity with MANTIS caused frustrating delays while features and capabilities were explored. An extended learning period with less ambitious projects would have improved programmer satisfaction.

The Information Specialist Environment

We will define the information specialist as an individual with responsibility for areas such as the user liaison function, user training, and user consulting. Academic backgrounds vary, and professional training need not include programming and/or formal education in information systems development. In fact, information specialists may more likely have formal training in one or more areas of user expertise. Examples include registrars, institutional researchers, budget analysts, and admissions officers. Computing experience is usually developed as a natural by-product of activities as computing users.

The developmental environment in this case might well be under the aegis of an information center. For this group of individuals, in addition to the basic skills required to use the available fourth generation tools, training must include strong emphasis on the design and functions of existing university information systems. In addition, training should include the appropriate policy/procedural issues and some information about how to train users. These individuals will become the primary trainers for the user community.

Although the classical approach to an information center would suggest that applications are developed by end users not by information specialists, clearly these individuals have become users in their own right. In addition to training and consulting activities, however, information center staffs can become involved in ad hoc programming, probably out of necessity rather than as a result of a mission definition. In the information center developmental environment, then, fourth generation tools have a high degree of support andstrong staff advocacy. This is due to both the nature of the center's mission and because fourth generation tools are one of the primary agents for the center to accomplish its mission.

The information specialists have had the broadest exposure to fourth generation tools. It is from this group that data processing departments may ultimately derive the most productivity from these tools. Unlike programmers, this group can usually gain higher levels of proficiency with these tools because they use them on a regular basis and training end users to make use of them.

At WMU consulting support for EASYTRIEVE applications has been available for many years. This service has produced individuals with a high degree of skill for using this product to satisfy on-going or ad hoc reporting requirements.

Recent additions of SAS and MANTIS have provided new tools for which proficiencies must be developed and appropriate uses found. Two projects exemplify how these products are being integrated into the available application development tools of the information specialist.

A data entry system was written using MANTIS for the Public Safety Division. The application system is designed to collect parking violaton ticket information on a daily basis. The system is menu controlled and provides capabilities for entry, editing, search, and retrieval of parking ticket information. The initial MANTIS learning curve for the developer of this application was expectedly slower than a programmer. But techniques learned early in the development were easily recalled and used later in the process.

This application has now been scheduled for production implementation. Because of the ability to "prototype" the application for the end user and to interactively build and modify screens during the development process a high degree of user satisfaction upon implementation is expected.

The specialist who developed this application noted none of the concerns about the process expressed by the programming group. The most serious difficulty encountered was with file interfacing and a lack of knowledge about the TOTAL database. The overall reaction to this experience was very positive. There was strong acceptance of the product and anticipation that it would be a useful tool for assisting end users in developing other applications.

SAS was first used and introduced to the administrative end user community when an ad hoc report request was presented by the personnel department. Typically this type of request would have been an EASYTRIEVE application, but in an effort to use and expose new tools and services to the users, SAS was selected for the project.

User reaction indicates that the ease of using SAS commands for producing formatted list reports, and graphic data representations may quickly make it the language of choice over EASYTRIEVE for certain types of ad hoc requests. Additionally, SAS may prove to be a more pallitable product for encouraging end-user development of their own applications.

The End User Environment

This aspect of the discussion will focus on those users who are not members of either computing center staffs or of information center staffs. They are, in fact, the primary audience for which fourth generation tools are actually intended. Academic-professional backgrounds are appropriate to the area of the user community in which an individual is employed.

Training is conducted by a number of groups. Examples include information specialists, data center employees, and vendors. Training, which is typically limited to the use of a given product, is often at a somewhat abstract level of a description of a product's features and how they work. The training should more appropriately be application oriented and should therefore include strong components of all applications systems applicable to a given user area. The intent should be not only to develop expertise in the use of a given tool, but also to develop "better" users -- those able to participate more fully in the planning and direction of the university's large scale, centralized information systems. Denise (1983).

In the same sense that few are more enthusiastic about a new product that the product's developers, end users who successfully apply a fourth generation tool to a problem in their area typically become among the strongest advocates of the tool. As such, their experience presents opportunities upon which to expand the development of end user computing. Techniques include user office demonstrations, consulting, and return on investment arguments -- all of which are effective methods to strengthen the base upon which the end user community is building. As a result the natural tendency for the users to be highly supportive and positive about fourth generation tools will continue to be reinforced.

While end users have had access to EASYTRIEVE for many years, perhaps the most productive use of fourth-generation products is coming from the newer mocrocomputer-based products. Several examples will serve to illustrate this trend and it's potential impact on data processing.

Multiplan has become the staple spreadsheet software for financial administrative applications on microcomputers. In some cases, data which has been compiled through the use of EASYTRIEVE reports is subsequently loaded to a Multiplan spreadsheet. Using the same skeletal shell month after month eliminates the need for proof reading, footing and ticking. The next logical step will be to directly link the data created by EASYTRIEVE to the already created Multiplan spreadsheet. Utility programs such as LOADCALC appear to possess the capability to bridge this gap. A project to test the feasability of this concept is under consideration at the present time.

Some applications have been best handled completely through Multiplan with no interaction with the mainframe computer. An example of this is the Daily Cash Expense and Receipt report and the Cash Percentage report generated for WMU's Office of Investments and Risk Management. In this case, a very sophisticated application was developed for the Investments Office to reflect the daily impact of cash inflows, outflows and investments. In addition, the various fund entities were calculated as a percentage of investment ownership on a daily rolling basis. This application is an example of optimal use of the data center specialist as a consultant. If this application had been attempted as a traditional mainframe project, the development time would have been longer, the user would have had a less flexible solution, and data processing would have responsibility for maintaining the product.

From a user perspective, there are several benefits to a product such as MANTIS. First, even when the product is used solely by a data center programmer or specialist, the end user can get a preview of data entry screens before a significant amount of effort has been expended. This is especially important when systems are being refined on an "as you go" basis. Second, the end users can now request applications which would have been a substantial commitment of human resources if programmed through the traditional CICS environment. A general ledger on-line data entry system has been quickly developed by taking advantage of these capabilities.

At this time, only data center staff are utilizing MANTIS. However, as with EASYTRIEVE, end users will undoubtedly utilize this tool to create inquiry and data entry screens in the future.

The dbase product has provided users an alternative method for developing certain limited application systems. An example of this is WMU's Department of Public Safety (DPS). DPS hasan application which collects tremendous volumes of detail crime statistics data on a tape-based mainframe system with a low keypunch and processing priority. DPS staff independently developed several separate microcomputer data bases which contained the specific data for victims, crimes, suspects, and property. Although these applications taxed the limits of Dbase II, the introduction of Dbase III will alleviate such problems. In any case, this application demonstrates an appropriate balance between micro and mainframe. DPS staff now have control over immediate data entry and file updating. This gives them a significant advantage in producing their detail weekly reports, which are printed directly from the micro. However, there is still a need for the capabilities of the mainframe processor. Monthly reports which involve indexing and/or sorting and then printing of the entire data bases would involve much more processing capability and much faster printing capability than can be found at the micro level.

The solution therefore, has been to upload the appropriate data to the mainframe via an IRMA board on the micro. Once the data has been received by the mainframe, it is then sorted and printed for reports and sent to tape for state police statistcal requirements. This application has accomplished two significant goals; first, it gives DPS better control and turn-around time and second, it relieves a substantial keypunch burden from the data entry staff in the data center.

PROJECT EVALUATIONS

Overall evaluations of fourth generation products from the user perspective are very positive. Applications have been successfully addressed in virtually every case. However, there remain areas of concern with regard to fourth generation products from the user perspective.

Fourth generation products can be of even more value when the micro/mainframe link is more fully refined. This is an area that WMU intends to explore in both current and future applications.

Tools such as MANTIS will open many doors for users on an institution-wide basis. However, care must be exercized so as not to jeopardize the control and integrity of system files and programs. Increased accessability must be monitored and evaluated.

End users should be encouraged in their usage and appreciation of fourth generation tools. However, there appears to be a danger that if left unattended, the user could easily wander off track and become inefficient and/or ineffective in his use of such products. For this reason, it appears necessary for the staff of the data centers to closely monitor all usage of such products.

Finally, even though there are many applications where the use of fourth generation languages is appropriate, it is important that users are taught and understand the proper use, limitations, and responsibilities that accompany their use.

Summary

The preceding discussion has outlined recent experiences with fourth-generation products at Western Michigan University. Three groups of individuals who developed applications using these tools were described and several of the specific applications were presented.

User reactions to the experience of using fourth-generation products were all positive. Programmers appreciated the ability to quickly develop and modify input and output procedures but expressed the clear necessity for a good screen editor and comprehensive text-handling facilities in any product to be used for complex development. Information specialists found the "prototyping" capability to be an excellent way of directly involving users in the development of their applications. End users who have utilized the batch reporting and analysis packages were pleased with the product capabilities and with their own independence to handle ad hoc reporting needs. Those end users who have developed stand-alone microcomputer applications using fourth generation software have gained further insight into computing and will be the first of a new generation of computing users who will cooperatively develop applications with the data processing department taking advantage of both the mainframe and microcomputer capabilities.

Management of the fourth-generation "experience" is in many ways similar to any other product acquisition project. First an assessment must be made of the match between available products, organizational needs, and staff capabilities. Because some products are better as report writer, others as query tools, and still others for systems development, the needs of the organization should help clarify the type of product which will be most beneficial.

The professional level, competence and availability of the staff who will use the product should be given appropriate consideration. There are a number of questions to be considered. For example, does the product have a sufficiently rich language and editor to support your programming staff? Are its features too complex for your user community? How much training is required (available) in order to use the product to it's best potential?

The technical features and capabilities of a desirable product may be related to your data processing environment. The abilities to interface with an existing database or file structure, or to "call" external procedures from your application library may be critical issues in your considerations. Additionally, if incorporating microcomputers into your systems plan is important, the selection of a product that either supports micro-mainframe interaction or has compatible micro and mainframe versions can present a useful solution.

Western Michigan University is committed to responsibly putting more and more computing services into the users hands. To that end the continued development and dependence on fourth-generation products for applications development will be encouraged and enhanced in the future.

References

Denise, R.M. Technology for the executive thinker. Datamation, June 1983, 206-216

Glover, R. A Fourth generation approach to decision support in a private university. Twenty-Fourth Annual Forum, Association for Institutional Research, Fort Worth, May 6-9, 1984.

Goetz, M. Engineering 4th generation system software. Computerworld, June 7, 1982, 1-14.

Martin, J. Application Development Without Programmers. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1982.

Moskovis, L., Staman, E., Litaker, R. The Information/Decision Support Center. CAUSE National Conference, San Francisco, December 11-14, 1983.

A STATEWIDE REPORTING SYSTEM PAYS OFF

The Virginia Experience

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In 1980, the Council of Higher Education for Virginia wrote software which would produce federal and state enrollment reports and provided this software to its public institutions for their use. Reprogramming necessary to handle changes in HEGIS, OCR and state enrollment reporting are done once, by Council staff, and distributed to the institutions. The software includes conversion capabilities from institutional to federal and state coding, and edit procedures. One edited file does eight different reports, providing computer generated forms and magenetic tape submissions that produce consistency across an institution's reports.

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A Statewide Reporting System Pays Off
The Virginia Experience
by
Fletcher Carter and Jean Keating

As long as institutions of higher learning have existed, there have been reports to be made to some authority whether in the form of an annual report or in a daily chronicle. Our histories of medieval universities would be incomplete without reports made by the masters to their bishops or kings. The annual reports of the Board of Overseers of Harvard College are a most valuable source of information about early institutions in Colonial America.

From the time of its establishment in 1867, the United States Office of Education has been the nation's chief collector and disseminator of educational data. Each year the Office of Education in conjunction with the Office for Civil Rights collects enormous amounts of data through its Higher Education General Information Systems reports and the OCR reports. Among these reports are institutions characteristics which are collected for the Educational Directory. Other reports regarding student enrollment and migration, graduates, financial assistance, faculty and salaries, financial profiles and library statistics are collected by this office each year. The Biennial Report of Education produced by the U. S. Office of Education has long been the principal source of both public school and college statistics in this country.

In recent years, the very size of these reports and the amount of data returned has put a severe strain on the colleges to report the data as well as on the Office of Education to collect and analyze the data. In an effort to overcome some of these difficulties, the Department of Education has subleased several of these reports to independent companies. Among others, the Chronicle Data Service is attempting to market HEGIS data collected in this manner.

Prior to World War II, public higher education in the United States was quite small. The largest universities rarely exceeded four thousand students. Although most states had experimented with methods of centralized control of higher education, it was not until the impetus of the "baby boom" of the late fifties and early sixties that legislation was passed establishing centralized control and reporting. Many states have central governing boards which have final authority over programs, finances and enrollments. Examples of central control boards are Georgia and Florida. Other states, including Virginia, have a coordinating board which attempts to coordinate rather than govern their public institutions. Still other states have multiple boards or no central boards at all.

Prior to 1956, Virginia's public colleges and universities were independent under their own Boards of Visitors which were appointed by the Governor. Except for Federal enrollment reports and the President's reports to the local board, no official records or reports were made to any other agency, Federal or state.

In 1956, the Virginia legislature established the State Council of Higher Education for Virginia (SCHEV), and charged it with coordinating the Commonwealth's public colleges and universities and with providing a variety of other services to higher education. One of the first acts of the Virginia legislature after the establishment of the State Council of Higher Education for Virginia (SCHEV) was the mandate to make a five-year plan. The same act authorized the public institutions to employ officers of institutional research to collect and analyze data for planning and reporting purposes. Almost immediately the council began requesting statistical information from the various public institutions including data needed for its own planning such as enrollments, enrollments by city, county and age, enrollment projections. In addition, data requested by other state agencies such as Buildings and Engineering, found its way into annual reports such as space inventories, utilization studies and capital outlay projections.

Over the years there was a trend toward strengthening the authority of the Council and adding to its duties. This trend culminated in 1974, when legislation was enacted to clarify the Council's responsibilities in higher education budget review. By 1976, the rapid growth of the institutions because of the expanding population was beginning to subside. The legislature mandated that the Council attempt to control college expenditures by evaluating and controlling new programs.

In 1973 Virginia's Council bought portions of the Costing and Data Management System software developed by the National Center for Higher Education Management Systems (NCHEMS) and modified it for use by Virginia's public colleges and universities as a costing and resource usage report and as a means of evaluating proposals for new programs. By 1975, usage of this modified software, dubbed the Virginia Information Exchange Procedure (VAIEP) became a reporting requirement, making access to or acquisition of computers for administrative reporting a must for all public institutions in the state.

By 1978, Virginia's Council of Higher Education acted as the HEGIS coordinator for the collection, editing and reporting of HEGIS data from both the public and private institutions, coordinated the collection of responses to reporting forms originated by the Office of Civil Rights, as well as collecting numerous additional reports for its own use.

Virginia's Council did not and does not deal with reports relating to the Vocational Educational System, nor with National Science Foundation reports. The collection of personally identifiable personnel data by the Council was dropped in 1975. Today, personnel data by individual and the bulk of finance data are handled by Virginia's Department of Personnel and the Comptroller's offices, respectively.

Routine reporting efforts were coordinated by the Research and Information Systems Section of the Council. Council staff work closely with one individual at each of Virginia's public and private institutions who is designated as the reports coordinator for that institution.

In 1975, Virginia's Council began collecting data in machine-readable form from the thirty-nine public (four-year and two-year) institutions in the Commonwealth. Beginning with that year, all HEGIS, OCR and state reports were submitted in both hardcopy and machine-readable forms (magnetic tape or punched cards).

By 1978, the burden of reporting on the local institutions was increasing at an alarming rate. Moreover, inconsistences across reports of related data inundated national and state agencies under mountains of data which were of questionable accuracy and usefulness.

At the national level, this issue of reporting burdens was addressed by a Federal Paperwork Committee which called for dropping many reports and consolidating other reports. The idea was sound, but the effects were not. Administrative personnel with perhaps the best intentions but little appreciation of computer applications interpreted shading out cells of matrices as easing the reporting burden. National reports changed from year to year and added to the woes of institutions seeking to utilize computer retrieval and display to ease some of their reporting burdens.

A similar study in the Commonwealth of Virginia resulted in the discontinuation of a few reports, but most reports were viewed as necessary to audit enrollments, to assist in planning and to provide data for legislative study committees.

One of the outcomes of the Federal Paperwork Commission, however, was the direction by the Virginia Secretary of Education to the State Council to develop a system which would reduce the burden of reporting on the local institutions as well as reducing the cost of reporting both at the state and Federal levels. The idea for the system had been originally proposed at a meeting of institutional reports coordinators in 1976 but was deferred until all institutions had the required computing capacity for running the programs. By

1980, all public institutions in the state had acquired computers of sufficient power to implement the system and planning began immediately.

Much of the information requested by state and Federal agencies pertained to headcount enrollment with breakdowns in several ways. It was appropriate that the first efforts by Council staff were directed toward reducing the burden of student reporting.

Virginia's public institutions either wrote their own programs to extract the student information necessary for responding to these enrollment and completer reports or prepared them manually and then submitted the results in machine-readable formats to the Council. Because these reports have tended to vary in format and content from year to year, the same reprogramming of routines to reflect the HEGIS, OCR and state reporting changes were done by each of the institutions. The Council sought some way of eliminating this duplication of effort.

More specifically, the objectives of the project were to provide a system which would:

1) ease the response of state-supported institutions to existing requests for information from Federal and state agencies,

2) reduce the cost of generating the requested information,

3) and eliminate erroneous data and improve the internal consistency between reports, thereby reducing the follow-up contacts by state and federal agencies

There are several constraints on the system. The Council did not wish to replace institutionally written software for the reports were such existing software existed and where an institution chose to use it, nor did the Council plan to collect student-specific data. Furthermore, the software had to be transportable to whatever computer system the particular institution was using.

In 1980, the Council defined a standard student record to contain all information needed for the various reports dealing with enrollments and completers. Based upon this standard student record, the Council's staff wrote software which would edit and produce federal and state reports and provided the software to Virginia's public institutions for their use. Since that time, as reprogramming has been necessary to handle changes in HEGIS, OCR and SCHEV reporting modifications, the reporting changes have been done once, by Council staff, and the updates to the software have been provided to the institutions.

To use the software, each institution had to write programs that extracted the common set of data elements from their student files and created a modified student file according to the student record specified. The enrollment data were then converted and edited, and reports, magnetic tapes and computer printouts replicating the reports were generated by the SCHEV software. Some schools already had software developed in-house to do such reports and declined to use the SCHEV generated software, until changes to reporting formats and contents made it an acceptable alternative to rewriting their in-house software. Others with no software of their own immediately put it to use.

Originally, the Council-developed reporting system was named the Uniform Student Reporting Data System (USRDS). After considerable modification of the programs during the testing phase, the name was shortened to the Uniform Student Data System (USDS) which was in place for use by the institutions in the fall of 198~~7~~0

Virginia's Uniform Student Data System has three phases: conversion, editing and reporting. SCHEV supplies current files that are institution-specific and contain approved listings of degrees, student levels within degrees, as well as current listings of Virginia's city and county codes. Existing institutional files of students enrolled are converted to USDS acceptable codes using these SCHEV-supplied tables and other institutional-developed tables. For example, many institutions maintain course designations as departmental codes rather than the HEGIS taxonomy required by Virginia's state reports for disciplines.

The reports which can be generated by the system include the following HEGIS reports:

Degrees and other Formal Awards NCES 2300-2.1
Earned Degrees Supplement for OCR 2300-2.1S
Fall Enrollment and Compliance Report NCES 2300-2.3
Fall Enrollment Supplement for OCR 2300-2.3S
Residence and Migration of Students NCES 2300-2.8

and the following SCHEV reports:

Fall Headcount Enrollment by Residence R-1 Report
Summary On/Off-Campus Headcount Enrollment B2/B3
On-Campus Summary Headcount Enrollment by Age B5

The software edits the converted student records for missing data relative to all reports. When all data necessary for all reports are present and correct, display reports replicating each required student enrollment and completer report are generated by the software along with a machine-readable (tape) records. One institutionally generated file does eight different reports so consistency among reports is achieved.

At the present time, all of Virginia's public institutions use either this software package or their own in-house software to report, edit and submit all HEGIS, OCR and state reports relating to student enrollments and completers. The USDS software is maintained by Council staff for both IBM and H/P 3000 systems, one of which is in use by all but one of Virginia's public institutions.

Cooperative planning between the Virginia State Council and the individual institutions of higher education has resulted in a reporting system which will ease the reporting burden, save financial outlays in personnel and computer time and produce reports which are internally consistent and accurate. This system pays off.

BIBLIOGRAPHY

Meyer, A. E. : *An Educational History of the American People*, McGraw-Hill Book Co., New York, 1957.

Brubacher, J. S. and Rudy, W. : *Higher Education in Transition*, Harper and Brothers Publishers, New York, 1958.

Working Committee for Federal Paperwork Reduction, *Working Report*, Washington, D. C., 1976.

Uniform Student Data System Documentation, State Council for Higher Education in Virginia, Richmond, Va., 1981.

ADAPTING TRADITIONAL APPROACHES TO DERIVE BENEFITS FOUND IN THE NEW TECHNOLOGIES

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The immediate, positive user response to our announcement about the establishment of an Information Center resulted in a long waiting list of potential users. This paper is about one of the disappointed users who found herself near the bottom of that list. After identifying the results she hoped to get from using the new technology of the Information Center, we set out to find a way to meet those needs with other tools that were readily available. Using basic programming tools and MARK IV program skeletons liberally interspersed with comments, clerical workers in the user office are now performing a significant data retrieval function on their own. The result is a very pleased user who feels she has greatly improved access to her data. A potential problem is a marked increase in computer resource usage. This paper covers these and other benefits and problems. It also reviews the project development from planning through training to implementation.

PROJECT INTRODUCTION

The announcement that the office of Administrative Information Systems Development was planning to establish an Information Center was made in an informal way. Systems analysts and other data processing staff told their users about the plans indicating AISD was looking for an application to be used for the pilot project. I did just that for one of my users, the Alumni Records Coordinator at the University of Illinois Alumni Association, and even helped her write the letter of application.

The response was immediate and positive and resulted in a long waiting list of potential users. The literature recommended establishing a pilot project and bringing subsequent users into the Information Center one at a time. One user office was eventually chosen for the pilot and plans were made for the project.

It became my duty to tell my user that not only was her application not chosen for the pilot, but it was at or near the bottom of the waiting list. As I planned for the meeting, I realized that some alternative to waiting in line had to be offered. Since the new technologies of the Information Center weren't available to us, the alternative solution would have to be wrought using traditional data processing tools.

At the meeting, it became clear that the on-line IMS portion of the system had nothing to do with the user's reasons for wanting into the Information Center. Data retrieval for ad hoc reporting was the biggest problem. She said, "we have a good system for capturing and storing and changing data, but what good does it do us if we can't get it out when we need it".

The system's original report retrieval programs had long since been set aside as being inflexible and incapable of meeting ad hoc retrieval needs. The AISD Information Retrieval group had been assigned the task of writing programs to fulfill those needs. Because of the volume of work for the Alumni Association and commitments to other users, we weren't getting the work out as quickly as the user wanted. In some cases, they were not making requests for reports they wanted because of the backlog of uncompleted jobs.

As we reviewed the "hoped for" benefits of Information Center use, the user was able to identify precisely what she was after. A list of needs had been drawn up.

- Retrieve selected data from the data base, for reporting (i.e., alumni listings and mailing labels).
- Cut production turn-around time for ad hoc reporting.
- Access information on their own.
- Tools and techniques must be easy to use.
- Have more control of their data, system, and priorities.

The alternative we proposed was to make available program skeletons liberally interspersed with comments telling how and where to change code and then to teach the users to run those programs. Perhaps not as user friendly or as straightforward as the new tools of the Information Center, there was no reason the more traditional approach couldn't be adapted for use by the end-user.

ANALYSIS AND SELECTION OF TOOLS FOR THE PROJECT

I called on my colleagues at Administrative Information Systems Development for assistance in analyzing the tools available and in selecting those most applicable to our project.

- IBM 3270 display terminals
- TSO to provide access
- Data Set Manager and Full Screen Editor
- Service of the Information Retrieval Group
- MARK IV programs

The IBM 3278's were already in place in the Alumni Association offices. These were used for the on-line IMS functions of the system. Some work would have to be done to provide switching capability between the IMS Production Region and TSO. TSO is the time sharing system that lets you use the facilities of a computer at a terminal. The TSO command language provides access to the management and editing tools and to the data sets stored in "accounts" and provides the capability to execute programs.

We chose Full-Screen Edit (FSE) and Data Set Manager (DSM), a proprietary software product from Applied Software, Inc., from the group of management and editing packages we owned because they were the easiest to use and were familiar to the Information Retrieval programmers whose services were to be a most important part of the project. In addition to the original programming, those services would include consulting with the users once the project was implemented.

Finally, we decided to use MARK IV as the programming language for the skeleton programs primarily because that was the language used by our Information Retrieval group. For anyone unfamiliar with it, MARK IV, more correctly, the MARK IV Application Development Systems, is a proprietary software product developed, marketed and supported by Informatics, Inc. The developers of MARK IV have proposed, from the start, that it was designed to allow non-programmers to use MARK IV through the use of MARK IV structured forms. Teaching the users to code programs from scratch was not the focus of our project, but this did suggest that it might be easier for them to understand the code they were to be working with.

PROJECT DEVELOPMENT

Once the tools were selected, we were on our way. Our approach was fairly traditional even though what we set out to accomplish may not have been. Our project plan included many familiar steps.

- Management approval
- Planning
- Identifying report requirements

- Programming
- User training
- Implementation

We easily obtained management approval. The project wasn't going to require the outlay of any new cash. You can appreciate what a selling point that was. My boss was especially pleased to shorten the waiting list of unhappy Information Center hopefuls.

The project team was made up of The Alumni Records Coordinator, three data entry clerks from her office, three of our programmers (who, by the way, would not be relieved of any other assignments), and myself.

It was the users' task to identify the report requirements, i.e., the output format and the selection criteria for each. They also were to indicate which of those criteria they wanted to be able to change and which would remain constant. For each skeleton, they completed a form, already in use and familiar to users and programmers alike. The only difference was that a skeleton name was assigned to each and those criteria that they wanted to be able to change where circled. See Figure 1 for a sample.

The programmers wrote and tested the heavily commented skeleton programs. Figure 2 shows typical comments from a program. The programmers were instructed to write the programs in such a way that changes would be easy to understand and make. A rule of thumb, if they couldn't explain how to make the change in two or three lines of comments, then the change was probably too complicated. In such a case, we proposed a second program be written and in many cases, that's what we did.

During the programming effort, user training was being conducted. Training was my responsibility. We began with an overview of JCL and MARK IV. Our goal was recognition of the various parts of a program and a general understanding. That was followed by hands-on training at a terminal in the use of TSO and the Data Set Manager and Full Screen Editing packages. They also learned to schedule, check and route jobs.

We then practiced making changes to programs as instructed in the comments and running test jobs. In our discussion of programming errors and abends, the users were instructed to call our programmers for assistance. We have on-line access to their programs and are able to respond to a telephone request for debugging assistance.

From planning through initial implementation, the project took five months. At any given time, we generally have one skeleton revision or one new program in progress. Periodically, old skeleton programs are deleted because they are no longer needed. So in a sense, the process is on-going. There are approximately 30 skeletons in use by the Alumni Association today. A partial list illustrates the types of requests.

Skeleton	Format	Skeleton Criteria
A	Cheshire Labels	- for a selected constituent group in selected geographical area
B	Cheshire Labels	- same as "A" except for Alumni Association Members only
C	Cheshire Labels	- same as "A" except for Alumni Association Non-Members only
D	Chesire Labels	- for Alumni census form mailing
E	Avery Labels	- same as "A"
F	Avery Labels	- same as "B"
G	Avery Labels	- same as "C"
H	Cheshire Labels	- for the Alumni News mailing
I	Cheshire Labels	- for the Chicagoan mailing
K	Cheshire Labels	- for new graduates only
M	Roster Listing	- for a selected college
U	Cheshire Labels	- for selected campus and class years with class year page break and counts
V	Reference Listing	- same as "U"

PROJECT REVIEW AND EVALUATION

Try as we might to design and implement perfect systems, we normally don't succeed. Even though we consider this a "great application", there were and still are some problems that need addressed. We are working to correct these where we can.

The user has identified the following as the most serious problems with the project.

- It takes a lot more time to do this than to complete a request form and send it to Administrative Information Systems Development.
- The programmers' coding styles are dissimilar which is confusing. Comments are also dissimilar and sometimes not clear.
- The frustration of abends, bad tapes, lost output, etc., is a new and unwelcome experience.
- The initial weeks after implementation were unsettling. The clerks felt they were "left on their own" too quickly.

There are some additional problems from the data processing point of view.

- There was a marked increase in computer resource usage that had to be explained and justified.
- Providing debugging assistance has been a new chore and challenge for our programmers. Their own programming work is interrupted; the explanation of the problem is not always precise; sometimes needed documentation is destroyed before the programmer is called on.
- With turnover of clerical staff in the user office comes the requirement for additional training. And that training takes a lot of time.

Traditionally we have heard warnings against letting users have total freedom to access their data and predictions of increased resource usage if we should do so. Our experience has shown these predictions to be very accurate.

The number of requests that we processed for the Alumni Association during the first year of the project decreased from 383 for the previous 12 months to 145. But the Alumni Association staff processed 660 requests on their own for a total of 805 requests for the year, an increase of 422 requests, or 110%. This overall increase in requests was accompanied by a 231% increase in computer resource usage. These statistics are capable of causing considerable stress to those who must justify and explain them.

There are a number of reasons for the comparatively higher increase in resource usage. Many of the jobs submitted by the users have to be re-run. The more complex programs now being written by the programmers require more processing and in some cases require multiple passes of the file. A significant amount of new data from the alumni census, which was being conducted during this time period, was added to the file. Approximately 12,000 new degrees were granted during the year and the addition of those new alumni records increased the size of the data base.

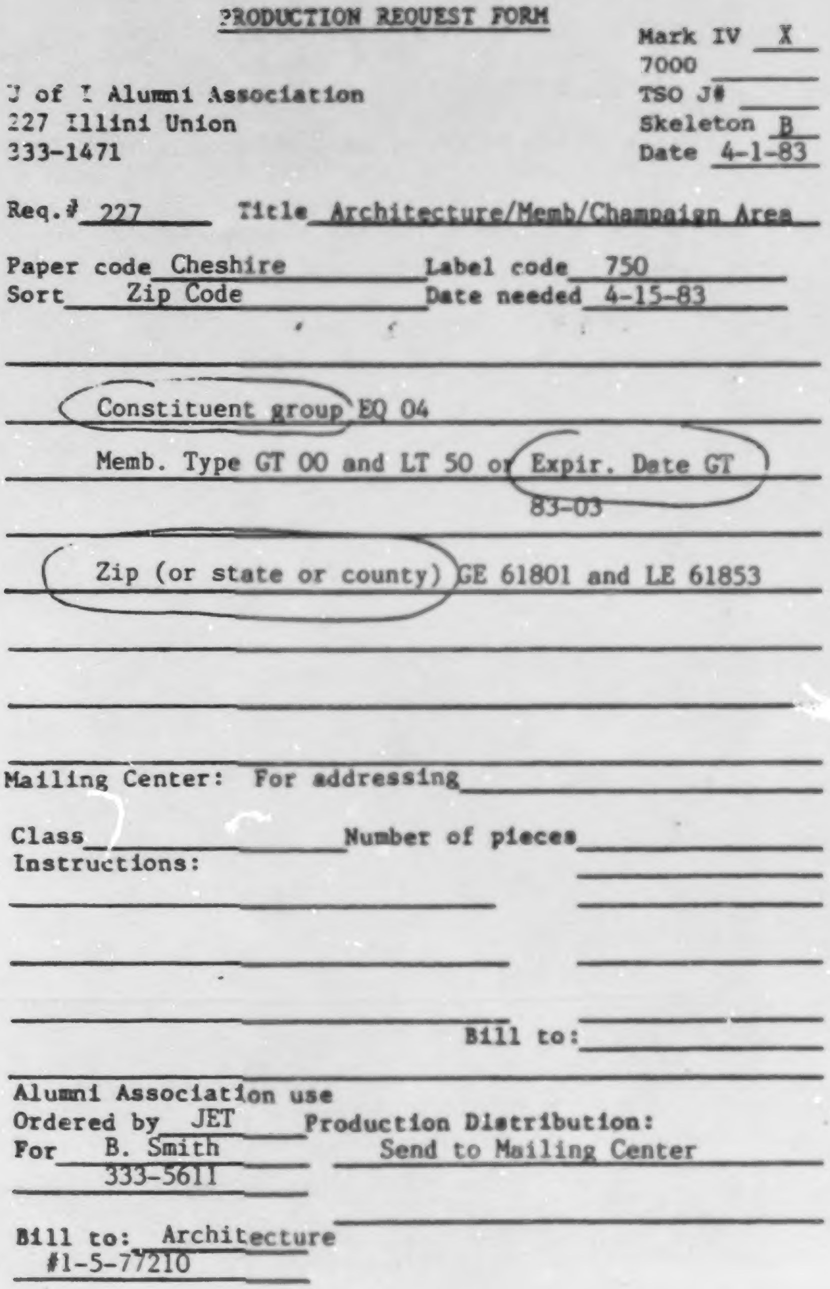
We justify the increase with one word, "service". The user is no longer saying she can't get information out of the system when it's needed. Clerical workers in the user office are now performing a significant data retrieval function on their own using traditional data processing tools. We consider the project a success and we have a very pleased user who feels she has greatly improved access to her data.

When discussing benefits, she says the greatest advantage by far is the speed in getting requests processed. Routine requests that did take two weeks are now done overnight. And the turn-around time for requests now sent to Information Retrieval is shorter in some cases because the programmers are not spending so much time on routine requests.

Other advantages mentioned by the users are:

- The ability to more closely control timing of production runs, i.e., hold them until a batch of updates are made to the file;
- The ability to see counts of selected records and to see actual output before it's printed;
- A better understanding of the data in the data base;
- Job enrichment for the clerical staff.

FIGURE 1



PRODUCTION REQUEST FORM

Mark IV X
7000
TSO J#
Skeleton B
Date 4-1-83

U of I Alumni Association
227 Illini Union
333-1471

Req.# 227 Title Architecture/Memb/Champaign Area

Paper code Cheshire Label code 750
Sort Zip Code Date needed 4-15-83

Constituent group EQ 04

Memb. Type GT 00 and LT 50 or Expir. Date GT 83-03

Zip (or state or county) GE 61801 and LE 61853

Mailing Center: For addressing

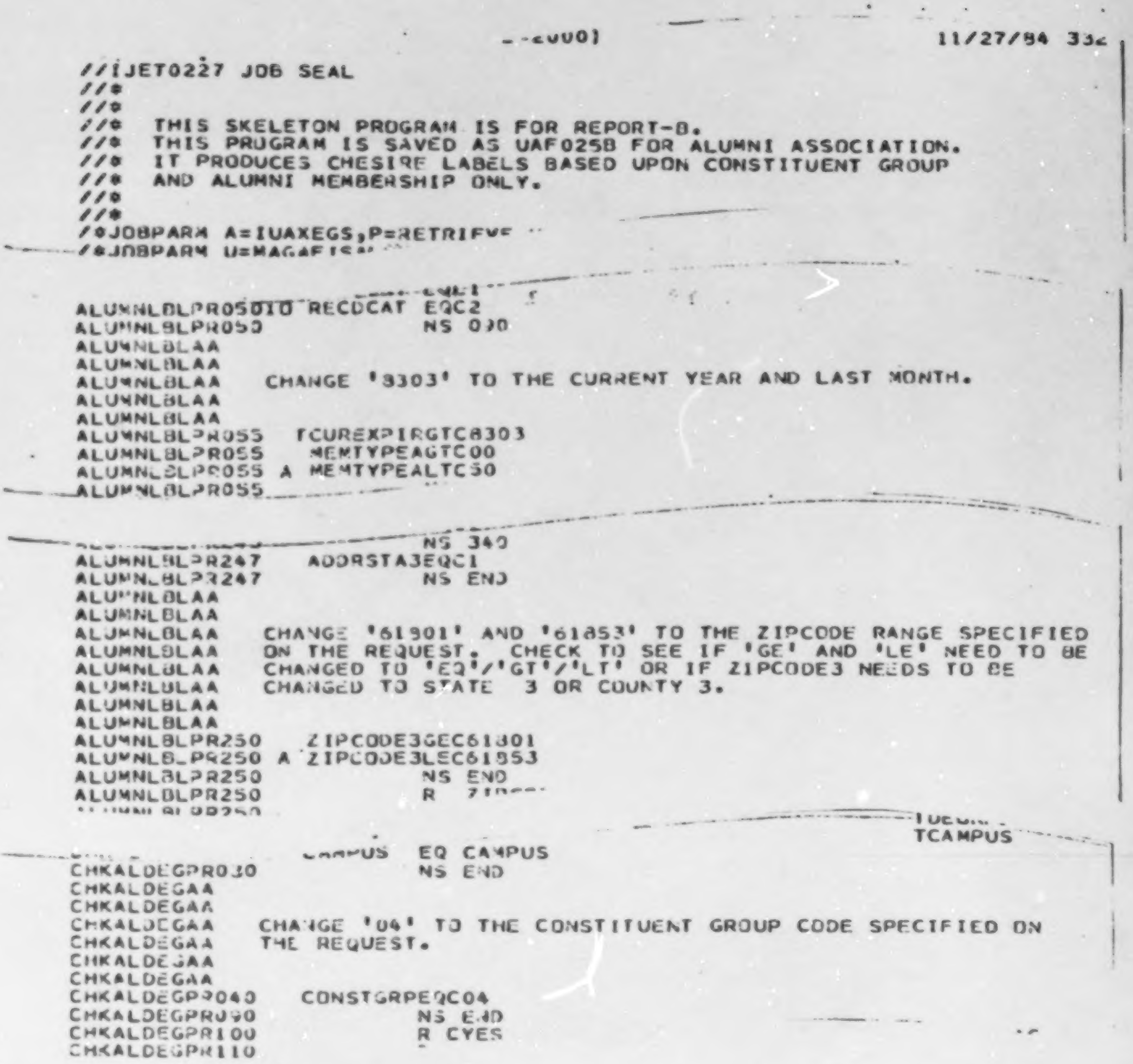
Class Number of pieces
Instructions:

Bill to:

Alumni Association use
Ordered by JET Production Distribution:
For B. Smith Send to Mailing Center
333-5611

Bill to: Architecture
#1-5-77210

FIGURE 2 SAMPLE COMMENTS



```
                                      --2000)                          11/27/84 33
//IJET0227 JOB SEAL
//*
//*
//*  THIS SKELETON PROGRAM IS FOR REPORT-B.
//*  THIS PROGRAM IS SAVED AS UAF025B FOR ALUMNI ASSOCIATION.
//*  IT PRODUCES CHESIRE LABELS BASED UPON CONSTITUENT GROUP
//*  AND ALUMNI MEMBERSHIP ONLY.
//*
//*
/*JOBPARM A=IUAXEGS,P=RETRIEVE
/*JOBPARM U=MAGAFIS

ALUMNLBLPR05010 RECDCAT EQC2
ALUMNLBLPR050             NS 030
ALUMNLBLAA
ALUMNLBLAA
ALUMNLBLAA   CHANGE '8303' TO THE CURRENT YEAR AND LAST MONTH.
ALUMNLBLAA
ALUMNLBLAA
ALUMNLBLPR055  TCUREXPIRGTC8303
ALUMNLBLPR055   MEMTYPEAGTC00
ALUMNLBLPR055 A MEMTYPEALTC50
ALUMNLBLPR055

                          NS 340
ALUMNLBLPR247   ADDRSTA3EQC1
ALUMNLBLPR247             NS END
ALUMNLBLAA
ALUMNLBLAA
ALUMNLBLAA   CHANGE '61901' AND '61853' TO THE ZIPCODE RANGE SPECIFIED
ALUMNLBLAA   ON THE REQUEST.  CHECK TO SEE IF 'GE' AND 'LE' NEED TO BE
ALUMNLBLAA   CHANGED TO 'EQ'/'GT'/'LT' OR IF ZIPCODE3 NEEDS TO BE
ALUMNLBLAA   CHANGED TO STATE  3 OR COUNTY 3.
ALUMNLBLAA
ALUMNLBLAA
ALUMNLBLPR250   ZIPCODE3GEC61801
ALUMNLBLPR250 A ZIPCODE3LEC61853
ALUMNLBLPR250             NS END
ALUMNLBLPR250             R  ZIP

                                                                 TCAMPUS
                  CAMPUS  EQ CAMPUS
CHKALDEGPR030             NS END
CHKALDEGAA
CHKALDEGAA
CHKALDEGAA   CHANGE '04' TO THE CONSTITUENT GROUP CODE SPECIFIED ON
CHKALDEGAA   THE REQUEST.
CHKALDEGAA
CHKALDEGAA
CHKALDEGPR040   CONSTGRPEQC04
CHKALDEGPR090             NS END
CHKALDEGPR100             R CYES
CHKALDEGPR110
```

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PROGRAM DESCRIPTION FOR

"BUDGETING BY MICRO WITH A MAINFRAME PARTNER"

James R. Hill

Steven A. Jones

Dallas County Community College District

Dallas, Texas

ABSTRACT

In our multi-campus (7) district, the partnership between campus micros and District mainframe provides budget managers with greater control and flexibility. It provides budget development on micros while maintaining the same edit controls and data integrity of the previous mainframe transaction driven system. Historical and current budget data is downloaded to a file server on campus, which can then be accessed by networked micros for cost center managers to create and maintain their budgets throughout the budget cycle. Periodic uploads will replace the existing mainframe data as review cycles complete. The system is designed to allow control and maintenance by Cost Center managers, Campus Business Managers and District Budget personnel.

DISTRICT STRUCTURE

The Dallas County Community College District consists of seven campuses with an enrollment of 100,000 students. Computing support, both administrative and educational, is centralized on three mainframe computers at a District Service Center (Chart 1). Over 400 remote terminals are used by students and administrative support personnel in an on-line interactive environment as well as 780 microcomputers in classrooms and offices throughout the District (Chart 2). There is currently one high speed line per location for microcomputer communication with the administrative mainframe. There is no micro educational interaction with the central site.

PURPOSE

The purpose of this paper is to describe our first effort to develop a micro-mainframe partnership to create and maintain cost center budgets throughout the fiscal year.

BACKGROUND

A District Committee completed work on a "Strategic Plan for Administrative Computing" in March, 1984 that determined the thrust of administrative computing for a three year time frame. One of the objectives was to continue in a centralized large system environment but continue to search for areas that distributed processing might prove beneficial. Also inherent in the plan was the use of microcomputers as a multi-function work station, linked together through local area networks with a gateway to the mainframe.

IMPLEMENTATION CONSIDERATIONS

In considering criteria for using a micro in a distributed environment, certain factors were identified as key issues: it must benefit the District support structure, not just an individual; it must be an application that requires decisions at various organizational levels, but utilizes centralized data bases; it must be compatible with existing application systems. Our current budgeting system, although automated, did not provide the timeliness useful to cost center managers charged with development. It also was not relevant to continuous monitoring subsequent to its creation that was needed throughout the fiscal year. The seed for a micro-mainframe distributed process was planted.

CURRENT BUDGETING

Currently the budget process begins with the creation of a Budget Development Worksheet created from existing general ledger expense accounts in our ADABAS data base management system. A subsidiary Personnel Report is also produced indicating current staffing and associated salaries. These reports are prepared by cost center and distributed to the appropriate managers for use in developing next years budget.

The cost center manager completes the worksheets projecting next years personnel, equipment and operating expense requirements. Input of requests is done by data entry operators using remote terminals to create input transactions. At periodic intervals, new reports are generated indicating the results of the transactions (Chart 3), and the cycle is repeated.

MICRO BUDGETING (PHASE I)

Although we still plan to utilize micros linked by local networks sharing disk files, the current state-of-the-art did not satisfy our requirements so we proceeded with an interim system until networks could be installed. The goal was to continue to utilize mainframe data bases and reports, but provide a tool for the cost center manager that was easy to understand and use, but also to indicate the results as they are entered and not have to wait 3-4 weeks for feedback.

The resulting system was designed under those requirements. Instead of creating printed worksheets, the information is downloaded to a micro hard disk in the campus business office. Micro programs create floppy disks with appropriate account information and are distributed to each cost center. The cost center manager, utilizing in-house micro programs, is able to "fill-in" blanks in their "screen" worksheet in much the same manner they used previously with pencil-paper. The difference is on-line editing and updating (on the floppy) as they project each expense.

When concluded, the floppy disks are returned to the campus business office where they are merged by micro with other cost centers to develop a campus-wide budget on the hard disk. The merged files can be viewed and/or modified by the Campus Budget Officer as they review with the respective cost center managers. Local reports can be created with ad-hoc report generator software. When completed, the budget information is uploaded to files on the mainframe. A batch process updates the data base budget records by replacing with new budget amounts. Existing system reports are still generated and distributed to the campus to compare with their own screens and reports from the micro process (Chart 4).

MICRO BUDGETING (PHASE II)

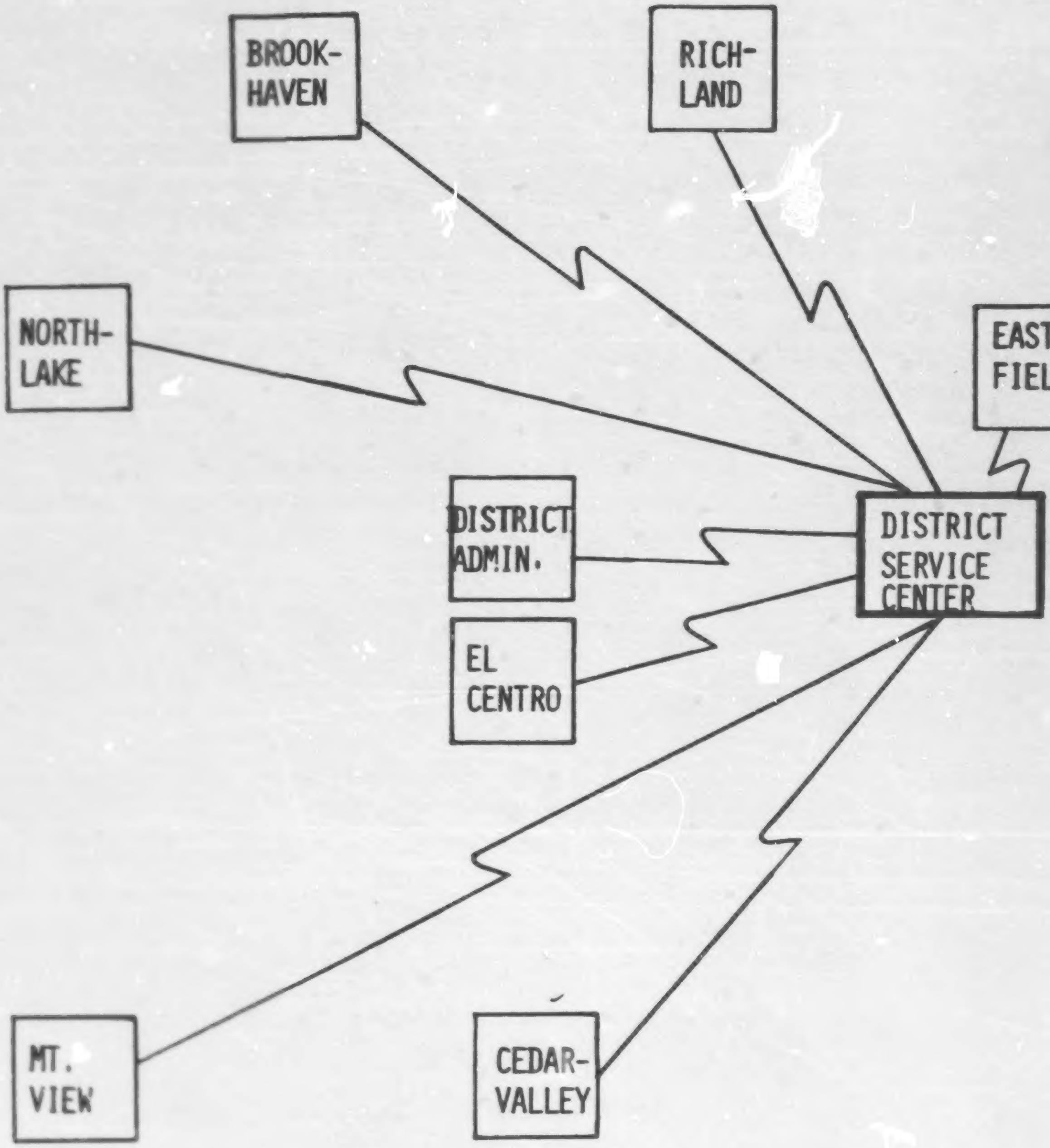
Phase II will provide a more efficient micro environment using a shared network hard disk. Budgets will be created by the cost center managers as before, but directly updated to the hard disk record (shared network files) rather than creating floppy disks, and then merging back together.

BENEFITS

Although this distributed system partnership has not been through the budget cycle yet, we feel the benefits will be evident in ease of use, less opportunity for errors, immediate results of actions, and a working budget tool that can be used throughout the fiscal year to modify budget figures as they are needed by the manager, and update master files on the mainframe as approved. The belief is that we have developed a productive, timely, distributed process and retained the nucleus of our existing system with District-wide benefits. A pilot will be conducted during the budget-build process this year with full implementation in September, 1985.

CHART 1

DALLAS COUNTY COMMUNITY COLLEGE DISTRICT


BROOK-HAVEN
RICH-LAND
NORTH-LAKE
EAST-FIELD
DISTRICT ADMIN.
DISTRICT SERVICE CENTER
EL CENTRO
MT. VIEW
CEDAR-VALLEY

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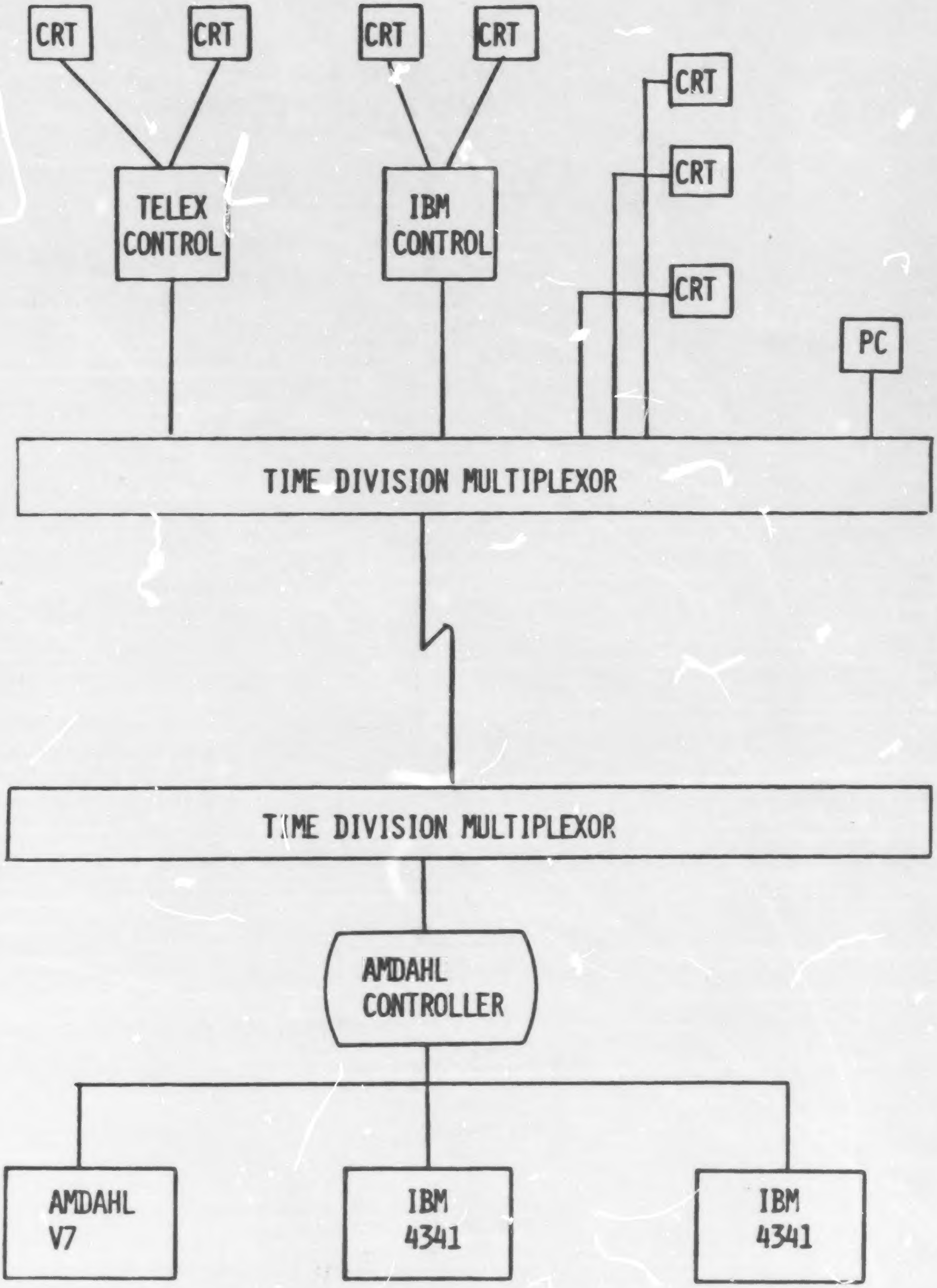
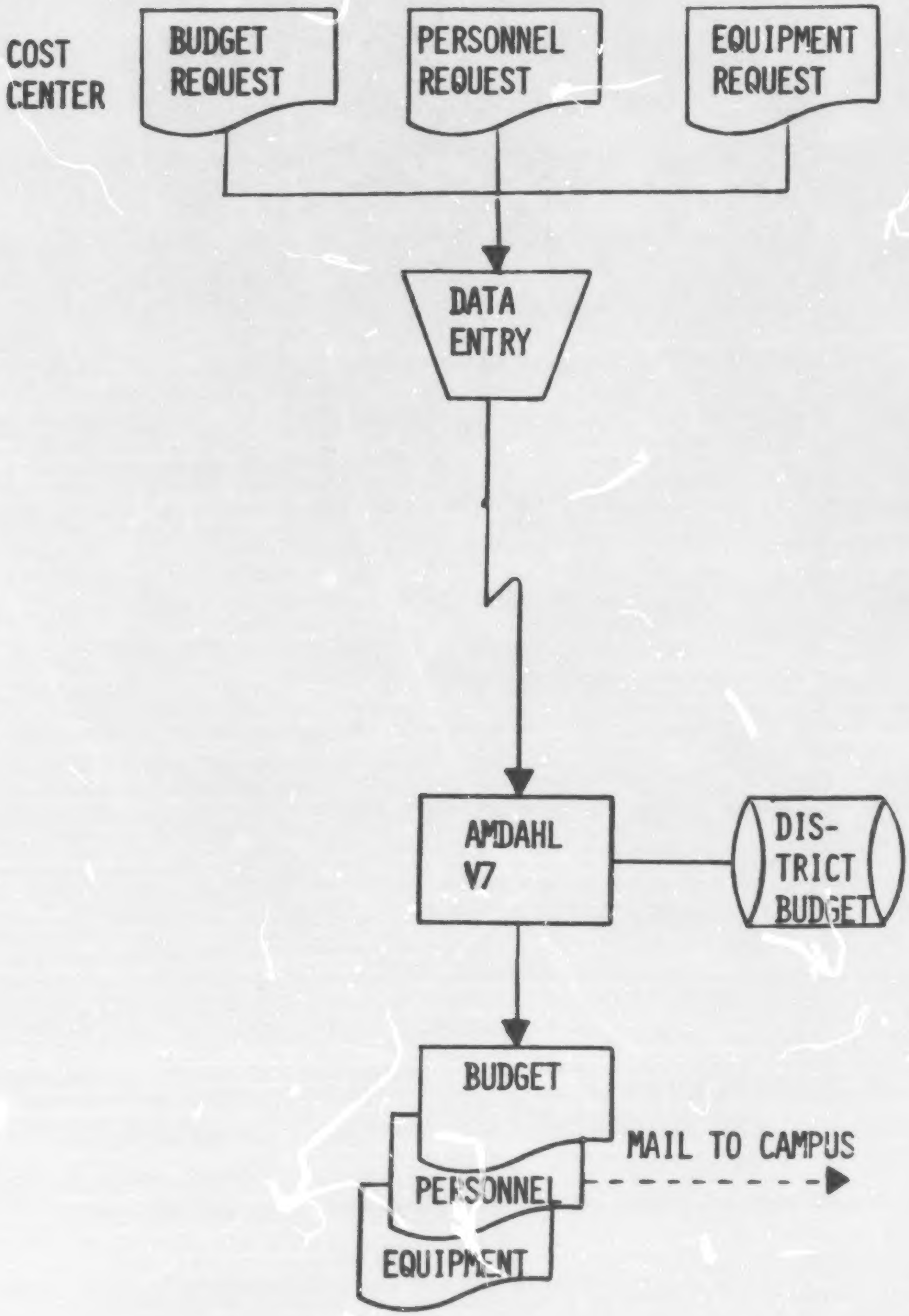
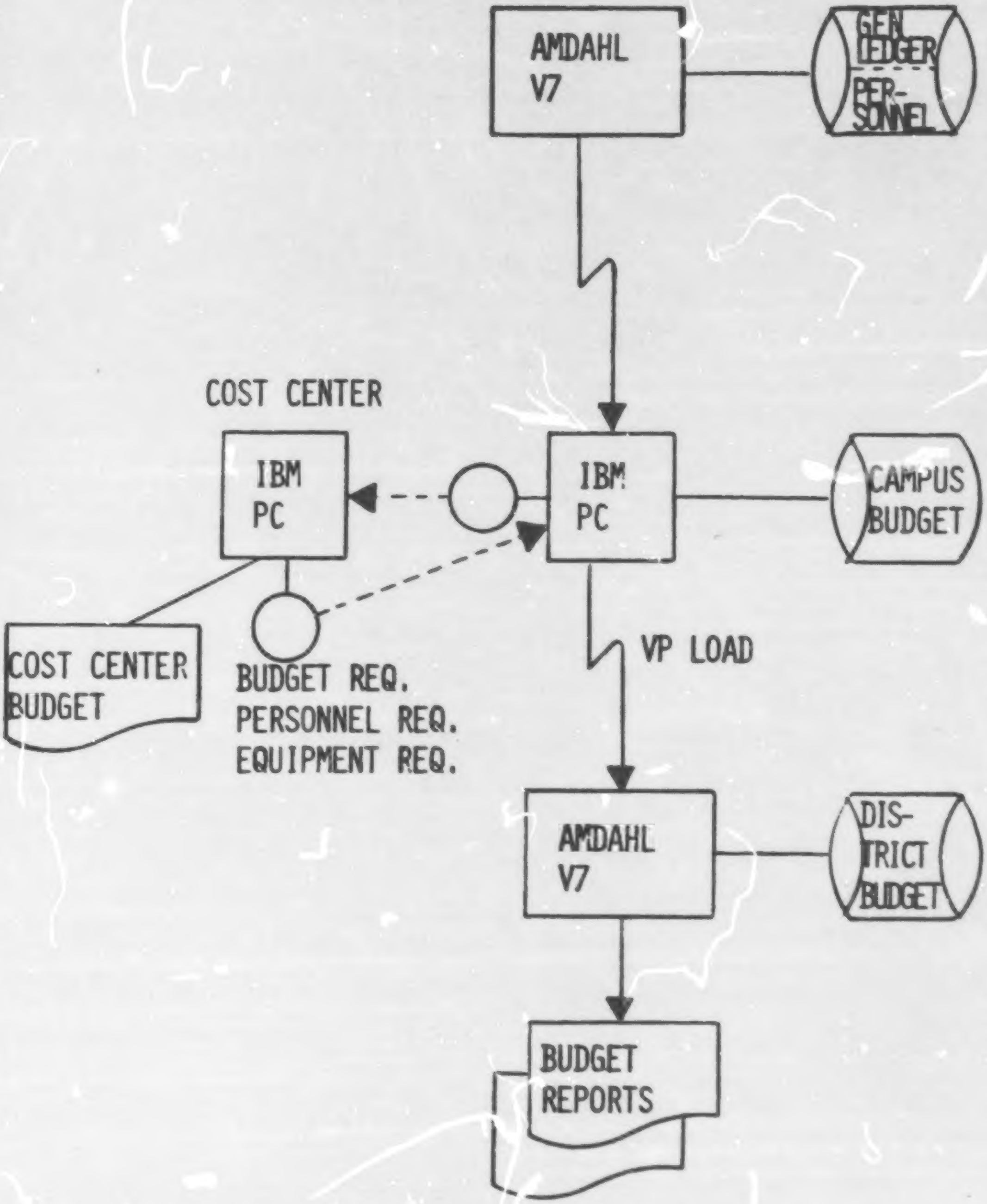

CRT
CRT
CRT
CRT
CRT
CRT
CRT
TELEX CONTROL
IBM CONTROL
PC
TIME DIVISION MULTIPLEXOR
TIME DIVISION MULTIPLEXOR
AMDAHL CONTROLLER
AMDAHL V7
IBM 4341
IBM 4341

CHART 3

MAINFRAME BUDGET (CURRENT)


COST CENTER
BUDGET REQUEST
PERSONNEL REQUEST
EQUIPMENT REQUEST
DATA ENTRY
AMDAHL V7
DIS-TRICT BUDGET
BUDGET
PERSONNEL
EQUIPMENT
MAIL TO CAMPUS

MICRO-MAINFRAME BUDGET (PHASE I)


AMDAHL V7
GEN LEDGER
PERSONNEL
COST CENTER
IBM PC
IBM PC
CAMPUS BUDGET
COST CENTER BUDGET
BUDGET REQ.
PERSONNEL REQ.
EQUIPMENT REQ.
VP LOAD
AMDAHL V7
DISTRICT BUDGET
BUDGET REPORTS

The Ingredients for the Successful Development and Implementation of IMS DB/DC Systems

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Louisiana State University

Baton Rouge

Louisiana

This paper will identify and discuss the ingredients which are needed to successfully design, program, and implement large IMS DB/DC Systems. A review of our five year development effort has identified these ingredients and an understanding of the characteristics of a successful project should help managers determine which projects have the best chances of being successful, which are high risk and which are destined for failure. This paper will try to help the data processing manager count the cost before the battle is initiated.

INTRODUCTION

History determines that all data processing projects, whether a small maintenance change or a large development effort, are categorized as either a success or a failure. Our aim is to be 100% successful. Anything less is looked upon by our employers, our contemporaries, and ourselves as failure. In data processing the successes are often forgotten, but the failures linger forever. The key to success is planning. The key to planning is experience. The key to experience is a knowledge of history and/or "the school of hard knocks". I hope this paper can supply you with experience through an understanding of history.

To help you gain the correct perspective, the environment should be defined. Louisiana State University is a public university with a regular semester enrollment of approximately [illegible]0,[illegible]00 students. We have 45 analysts that support administrative data processing. Nearly half of these analysts are dedicated to large system development while the other half maintain existing systems and provide technical and data base support. The vast majority of our programs are written in COBOL, although we do use MARK IV, BQL and SAS as production languages. Our department's resource is an IBM 370/3081 with TSO and SPF running under MVS with ACF 2 security. Most of our development has been done using IMS DB/DC.

Our total development effort has been mixed with success, some qualified successes and a dramatic failure. Over the past five years we have developed and implemented the following IMS Systems:

- Admissions
- Evaluation of Transfer Credit
- Student Records Maintenance
- Alumni
- Purchasing
- Treasurers
- Traffic Records
- State Bond Commission
- Human Resource Management

We have also successfully modified and installed the Admissions and Evaluation of Transfer Credit Systems for the University of New Orleans, a sister campus. A total of over 100,000 analyst-hours has been expended on these systems and a detailed summation of some projects is available in Table 1.

Our basic goal in developing new systems is to consolidate data and provide the users with on-line and batch access to correct and up-to-date data. Our intention is to give the user control of and responsibility for his data. This atmosphere provides the users with a manageable amount of information to make management decisions in a timely manner.

Since this paper will concentrate on success, I would like to define this term. Webster defines success as "a favorable termination of a venture." Termination means "an end in time or existence", or to bring to a conclusion. A successful project has three characteristics:

1. The system, or venture, must be thoroughly defined.
2. The system should function according to the expectations defined within a reasonable time frame.
3. The analysts assigned to the project should be reassigned to new tasks after the system is installed.

Anything less should be considered a failure, including systems which are implemented one year and continually maintained year after year on a daily basis.

To insure success the following ingredients are necessary:

1. Priorities, with top management support, should be established and understood by all users of data processing resources.
2. A design methodology, which can be followed and understood by data processing, users and top management, should be available.
3. Knowledgeable users are needed who can:
    a. identify the needs of the office
    b. make decisions to change the flow of work in the office, restructure the organization of the office and change or create new policies
    c. be available to work on the new system.
4. A competent and educated programming staff with adequate technical and data base support is necessary.
5. It is important to have a good user and data processing relationship which is characterized by mutual respect, honesty and a willingness to understand the problems each face.

PRIORITIES

Planning is the first key to developing a successful Management Information System. The first plan developed should be by top management to insure that the systems which are designed and implemented will become a resource for the university management team. A five year development plan will establish the expectations of top management and provide the university community with the same goal. This long range goal should be established before a development project is initiated. After the university goals have been identified, the appropriate personnel in the data processing and user offices should be made available to work on the systems which have received highest priority. To allocate fewer resources than are required to meet the expectations of top management will only insure failure. A plan without resources and commitment is useless.

Before any data processing department starts a major development effort, one fact should be established. How many analysts are required to maintain existing systems? After that number has been established, more analysts should be made available to concentrate on development. How many, depends on the goals of each individual university.

DESIGN METHODOLOGY

The design methodology which has succeeded in our environment is a modified version of a structured method developed by IBM. Our design methodology consist of five phases:

1. Requirements Definition (RD)
2. External Design (ED)
3. Internal Design (ID)
4. Program Development (PD)
5. Demonstration and Installation (DI)

Each phase has a definite completion point. The design for a new system is done in the RD, ED and ID. A signed document by the user and data processing personnel indicate the completion of each phase. Work is not started on the ED until the RD has the approval and signatures from the user and data processing. The same is true of the Internal Design. After the ID has been approved and signed, programming can begin.

The users are heavily involved in the RD and ED, with less involvement in the ID and PD. System testing and installation requires heavy user involvement. Data Processing is involved in all phases of the design effort. We start with one or two analysts in the RD and escalate our involvement until the end of the PD phase, at which point the number of analysts needed decreases. Besides providing a structured and orderly design, the phases in our methodology are used by management to monitor progress of the development effort.

The Requirements Definition consists mainly of specifying the user's business functions and defining the functions which will be supported by the new system.

The External Design defines the data elements, forms, reports, screens, programs and the flow of programs defined in the system. A short description of each program, with the input and output files used, is also included in this phase. An estimate for the resources needed in the ID and PD are generated. The following formulas, derived from historical data and verified by experience, are used to establish deadlines:

$$\text{ID(elapsed days)} = \frac{P \times DID}{A}$$

$$\text{PD(elapsed days)} = \frac{F \times P \times DPD}{A}$$

P - number of programs defined in the ED
A - number of analysts available for phase
DID - 5 days/program for ID
DPD - 13.5 days/program for PD
F - 1.1 - 1.5 (depends on the extent of interface to existing systems)

The analysis in the Internal Design produces a document which contains the physcial and logical organization of each file and data base in the system, a detailed program specification for each program, all JCL and documentation for the operation's staff to run batch jobs and test materials for each program. The complexity of each program is also defined at this time and a more accurate estimate is generated for the completion of the PD. The anticipated installation date of the system is also set. Below is a table of the estimates which are used for each complexity level.

Complexity Level	Days/Program
I	6
II	12
III	24
IV	30

These estimates also include the time to test each program individually and to accomplish a system test.

Existing programs which will be changed to interface with the new system are also given a complexity level. Generally these programs are never given a complexity greater than I. On-line update programs and complicated batch update programs, with checkpointing, are given a complexity level of IV. No program is ever given a level higher than IV. If a particular programs is determined to be greater than a level IV, consider breaking it into multiple programs.

The formula for estimating the number of man days for PD is simply the summation of the product of the number of programs in each complexity level multiplied by the estimated number of days for each level. Dividing the sum by the number of analysts available in the PD phase gives the elapsed days for the PD phase.

$$\text{PD(elapsed days)} = \frac{(\#\text{I} \times 6) + (\#\text{II} \times 12) + (\#\text{III} \times 24) + (\#\text{IV} \times 30)}{\text{number of analysts}}$$

The Program Development phase consists of writing and testing programs, preparing user manuals, documenting new office procedures and training users and Data Control personnel. Numerous small changes are made to individual programs, but large system changes are not considered at this point. Major enhancements, which users identify at this point, should be postponed, if at all possible, to some time in the future so that the anticipated installation date of the system is not jeopardized.

The Demonstration and Installation phase is concerned with loading the files and/or data bases, putting the system into production and helping the user and Data Control operate the system. Again changes to individual programs will be necessary but changes in the functions of the system should be considered a separate project unless they are considered to be "show stoppers." Time the and resources needed for this phase depends on the history of the project. If there has been agreement and signed documents after the RD, ED, and ID this phase could last between three to six months. If the project has no signed documents of agreed specifications this phase will last one, two, or more years.

A by-product of the structured design methodology is an avenue to notify management of progress and a guarantee that data processing resources can be reallocated after the system is installed. If a department can not reallocate it's resources it has developed a system which I characterize as a "perpetual failure". The bitterness of such a system usually destroys the sweetness of any successful system which precedes or follows such a system.

USERS

Who is a knowledgeable user? Certainly knowledge - or interest - is not tied to organizational rank. A knowledgeable user should be someone who is familiar with office procedures and is in a position to change office procedures when necessary. A knowledgeable user needs to be flexible and should be able to understand data processing blueprints, design documents. This person needs an understanding of the methodology to be used and have a tolerance for time consuming and tedious work. A basic knowledge or an aptitude to understand the purpose and function of data processing techniques and capabilities is also needed. We have heard a lot about data processing analysts needing to be user friendly but a knowledgeable user needs to be data processing friendly.

After a knowledgeable user has been identified and management has sanctioned a development effort, a project team should be formed. This team needs to consist of user and data processing personnel who are willing to "listen".

DATA PROCESSING STAFF

Another ingredient which contributes to the successful development and implementation of an IMS DB/DC system is a competent data processing staff. There are three types of staff members needed to insure success:

1) Analysts - to design the system
2) Programmers - to program and test individual programs
3) Date Base Analysts - to maintain the data dictionary, create PCB's, DBD's and PSB's, define MFS and IMS gens and allocate and organize the physical and logical structures of the data bases needed.

Like designing new systems, developing a competent staff is time consuming, costly and is only accomplished by a deliberate top management decision to make this endeavor even higher priority than the systems desired. An institution's data processing support is the foundation for any IMS system. A solid foundation helps insure success and a weak foundation will surely generate failure or distress at best.

Developing a competent data processing staff is not a one-time cost; it is a continuous cost. Turnover is a fact of life, but education, training and developing back-up personnel minimize its effect. At Louisiana State University we have been able to educate new analysts with formal, intense, individualized instruction within one to three months, depending on the experience of an individual. Another three to six months of practical experience, under close supervision, is required to allow an individual to become familiar with our design methodology and programming standards and guidelines. The design methodology which we use is conducive to training and developing new analysts for back-up purposes. (An analyst who has helped on an External Design or an should be prepared to initiate a Requirements Definition.) Besides the initial year of education and training, an atmosphere has been established to allow project leaders to share their experiences, good and bad, on a weekly basis. We also rotate analysts on and off of projects on a regular basis and maintain continuity when a system passes from development to maintenance. Having back-up personnel is the key which allows us to enhance systems as management requirements change and/or increase.

USER AND DATA PROCESSING RELATIONSHIP

A healthy user and data processing relationship is paramount to developing a successful system. The project team should consist of individuals who are self-motivated, able to articulate their ideas and present them in a logical manner and capable of understanding and appreciating the ideas of others. These individuals should have the ability to objectively analyze functions, situations and potential solutions. Each team member should be able to make unbiased decisions based on facts, rather than politics and/or tradition. A spirit of cooperation has to reign in the RD and ED phases.

A system will never be considered a success if the users and data processing personnel do not develop a mutual respect and confidence in each other. The data processor has to take the offense to insure the user that he is there to help and be of service to the user department. It is the responsibility of data processing to not isolate the user with unnecessary detail and/or data processing jargon. To design a system with a strained relationship between members of a project team will only frustrate the participants and jeopardize the implementation of the system. The data processor needs to be a public relations expert and a salesman, with a high level of data processing knowledge.

CONCLUSION

IMS system development is not cheap. Louisiana State University has expended over 100,000 analyst-hours, a more than 70 man-year effort, within the last five years, to enhance the flow of university information. Our user departments have become "computer literate" through this activity. They have become more independent and autonomous from data processing and can now share data between departments in a more economical manner. They have instant access to their data and are producing reports on a daily basis using query languages. We have started to enjoy the fruit of our labor but our Comprehensive Management Information System is still in its infancy. Top management recognizes the benefits associated with the development of a Management Information System and are committed to enhancing our existing systems and expanding our development activity. Some of the systems planned for the future are:

- Degree Audit
- Housing
- Student Registration
- Accounts Payable
- Centralized Accounts Receivable
- Library

Development of a Comprehensive Management Information System requires a commitment of resources and a willingness to set goals and priorities by top management. This direction and guidance creates an atmosphere between users and data processing personnel which stimulates cooperation. The goals of top management need to coincide with the quantity and quality of the resources which top management has made available to the development effort. Using a structured methodology will help insure progress and completeness. With these simple, but comprehensive and expensive ingredients our experience suggests that any university can establish a meaningful and useful IMS Management Information System.

SYSTEM/PHASE	PROGRAMS	DATES	MONTHS	HOURS
Admissions				
External Design	75	2/1/79-9/8/80	14	2,050
Internal Design	110	4/9/80-10/31/80	7	2,840
Program Development	103	8/11/80-2/12/80	18	11,644
In production May 4, 1981				16,534
Purchasing System				
External Design	75	9/1/79-6/2/80	9	504
Internal Design		6/2/80-1/31/81	8	2,315
Program Development	82	1/5/81-10/12/81	10	4,251
In production July 1, 1981				7,070
Treasurer's Office System				
Requirements Definition		2/1/80-5/22/80	4	330
External Design		5/22/80-9/5/80	3	816
Internal Design		9/5/80-5/14/81	9	2,804
Program Development	63	5/15/81-3/1/82	10	8,363
In production Jan. 4, 1982				
Enhancements		3/1/82-11/16/82	9	2,156
				15,469
Records and Registration Study		9/16/80-12/3/80	3	340
Student Records Maintenance				
Requirements Definiton		2/3/81-4/29/81	3	202
External Design	86	4/30/81-12/17/81	8	1,366
Internal Design	119	1/15/82-8/19/82	7	2,225
Program Development				
Phase I	39	7/18/82-2/28/83	7	3,935
In production Jan. 15, 1983				
Phase II	50	12/1/82-5/27/83	6	2,610
In production May 2, 1983				
Enhancements		8/26/83-12/2/83	3	1,343
Phase III		11/28/83-7/9/84	7	3,698
In production July 9, 1984				15,379
Evaluation of Transfer Credit				
External Design		4/30/81-7/19/81	3	in SRM ED
Internal Design	15	7/20/81-10/29/81	3	364
Program Development	19	10/7/81-4/29/82	7	1,593
In production May 3, 1982				1,957
Export Admission to UNO				
Design Phase	105	8/9/82-12/21/82	4	1,377
Program Development		1/3/83-10/3/83	9	2,069
In production Sept. 19, 1983				3,446
Export Transfer Credit to UNO				
Design Phase	30	8/26/83-1/13/84	5	1,042
Program Development		1/3/84-4/27/84	4	906
In production April 16, 1984				1,948

TABLE 1

SYSTEM/PHASE	PROGRAMS	DATES	MONTHS	HOURS
Human Resource Management				
Prior to Jan. 1983				
Design Phase		1/20/82-2/1/83	12	10,645
Program Development		8/2/82-2/1/83	6	4,839
After Jan. 1983				
Design Phase	52	2/1/83-4/2/83	2	3,609
Program Development	50	3/14/83-8/31/83	5	6,340
In production July 13, 1983				
Correct data on database		9/1/83-12/15/83	4	1,520
Enhancements		9/1/83-present	15+	7,297+
				34,250+
Payroll				
External Design	30	11/28/83-3/15/84	4	382
Internal Design	32	1/23/84-5/31/84	4	856
Program Development	57	4/26/84-present		3,931+
				5,169+
Budget and Raise				
External Design	22	11/15/83-3/19/84	4	402
Internal Design	22	2/6/84-6/29/84	5	814
Program Development	34	3/15/84-10/31/84	7	2,320
				3,536
System Personnel Information Network				
Requirements Definition		2/10/81-5/4/81	4	514
External Design		4/11/81-5/15/81	1	330
Internal Design		5/12/81-9/30/81	4	836
Program Development	86			
Phase I (SPI)		9/11/81-9/23/82	12	5,487
Phase II (SPIN)		9/23/82-8/23/83	11	1,188
In production Aug. 1, 1983				
Enhancements		9/1/83-8/6/84		1,473
				9,828

TABLE 1

Description of Information Associates' Z/SIS System

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November 27, 1984

This paper examines the functional divisions of labor and underlying structural design of Information Associates' "Z" Student Information System. Z/SIS is a general purpose "menu-driven" system. The general form and content of the menus are described. Internal processing is described in sections on the Z utility and SIS application components. A description of data entry and programming tasks required to make Z/SIS the system of record at Dartmouth is provided.

Introduction

Information Associates' Z-based Student Information System (SIS) is designed to keep administrative records in four broad areas: Admissions, Financial Aid, Student Records, and Billing/Receivables. Within each area, administrative tasks are performed by calling up screens, entering required data and pressing the <return> key. Internally each task is performed by one or several programs under the control of a dispatcher, the Z control module.

Functional Organization

All screens are defined using a common format consisting of a context window, a screen body and an error message window. This scheme is shown in Diagram 1.

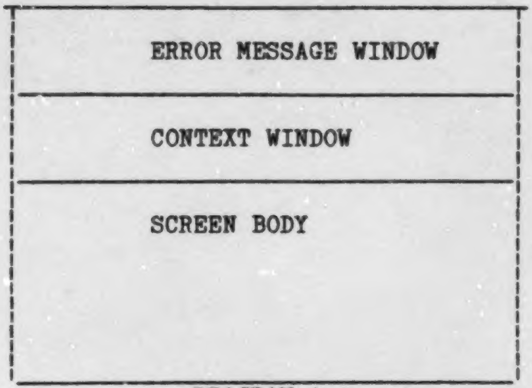


DIAGRAM 1.

The context window defines the subject of an administrative task: a student, a course, a course roster, an admissions or financial aid applicant. The screen body is a mosaic of windows in which data about the subject is entered, displayed and changed. Data entry errors are identified by highlighting the window holding the incorrect value. Text relevant to the error appears in the message window.

A person's records can be called up by using an ID code or by typing some or all letters of the last name. If duplicate names exist, then all are displayed. The user then selects the entry that identifies the subject of the query.

Each screen is dedicated to a specific task. The user selects a task by typing a screen number into the context window. During data entry, the user may request help text for each data item defined on the screen. A help request is recognized when the user types <CNTL Z> (a VT100 gold key). The Z/SIS system uses the CRT's cursor position as a pointer to the data item for which help is requested.

The user defines separation of administrative function by controlling who may use the screens. For example, screens accessible to Financial Aid's operations need not be shared with any other administrative group. Separation of function may be further defined within each of the four administrative areas. Also, screens may be shared across administrative boundaries.

The screens are well designed, but the short labels used to identify them on the master menus are not always meaningful. These can be easily changed to reflect the users' local terminology.

System Organization

Transitions from one administrative task to another are handled by a combination of Z and SIS software. The task itself is carried out by one or more SIS programs which call on Z services to validate data, obtain help and do file maintenance.

Z/SIS is a two layered product. I have divided my discussion to emphasize this layering, but in operation Z/SIS is constantly shifting between these layers.

Z/SIS is also a table-driven system. This means in general that a non-programmer may define system behavior by altering certain core data. In the best case these alterations suffice to produce needed changes. The convenience of table-driven design benefits technicians as well because a majority of changes require no programming, and significant extensions require only confined changes to a single program. Many extensions can be introduced by copying an existing program, changing it to reflect the new requirement, then including both old and new programs into the components list of the system. New or revised functions may "run parallel" with existing functions.

Table-driven design was the primary reason that attracted our product search committee to the I.A. product. A year's analysis showed us that the details of Dartmouth administrative practice would not be found in any generalized product. Consequently, in analyzing offerings in the software marketplace, we were as interested in flexible architecture as we were in the repertory of user functions. The modifications described later in this paper have been implemented largely through the excellence of Z design.

Most of Z/SIS table-driven design will be covered below. However, before discussing specifics, I will describe a generic table-driven system. In such a system, component interrelationships fit the pattern shown in diagram 2. The boxes show these relationships in the context of Z/SIS.

```
 ______________________________________________________________
|Z components                                      |            |
|                                                  |            |
|     Data Processing   -------> CONTROL           |  SERVICE   |
|     User Input                 TABLES            |  ROUTINES  |
|                                  |               |            |
|__________________________________|_______________|____________|
|                                  V                            |
|     Application       -------> APPLICATION                    |
|     User                       PROCEDURES  ------>OUTPUT      |
|     Input                      AND CALLS TO                   |
|                                SERVICE ROUTINES               |
|                                                               |
|SIS components                                                 |
-----------------------------------------------------------------
```

DIAGRAM 2.

The Z component of the I.A. product primarily resides in the upper rectangle. As the application runs, the SIS component calls on Z utilities to assist in carrying out user tasks.

Z and SIS components (like all computer system components) can be classified as either data or procedure. For example, tables controlling user access or containing data validation rules are data and must exist before the system runs. On the other hand, procedures which interpret these tables come into play only when the system is active. The terms I will use to make this distinction are "System Definition Components" and "Run Time Components."

Z System Definition Components

Data Base Definition Subsystem. This subsystem predates the Z product. It consists of a number of programs which "compile" a file of data descriptions. The "compiler" produces record maps, value constraint tables and a table of text suitable for responses when a user keys in a signal for help.

Z Security Subsystem. All users are described in a table which controls screen usage based on the user's identifier and processing intent (read or write).

A system administrator may assign security levels to each data element defined in the Data Base Subsystem and may also assign read/modify security levels to each user. The user's security level must equal or exceed the security level of the data element for data to be entered or revised.

Screen Definition Subsystem. All screens in the SIS package are fabricated by this subsystem. The user may define other screens to service additional or revised SIS tasks. Using the pool of DBD elements, a data processing user associates a screen definition with a meaningful subset of these elements. The Screen Definition subsystem is one of the keys to our successful adaptation of Z/SIS to Dartmouth's needs.

Subroutine Activation Tables. Each screen definition is coupled to one of these tables, and each table--the I.A. term is "procedure"--contains the names of the programs which actually alter SIS files. The tables define SIS "flow of control", performing a task which would otherwise complicate the logic of application subroutines. These tables vastly reduce the complexity of software changes and are one of the great strengths of the Z product.

All "procedures" contain the following steps:

1) Analyze the context line and decode the screen reference
2) Fetch the Procedure/Screen Definitions
3) Perform any necessary context switching (example: search by name rather than by numeric identifier)
4) Fetch data associated with screen body and keyed by the context line
5) Paint the screen
6) Wait for data entry
7) Analyze changes and reflect errors. If errors are sensed proceed to step 5
8) Perform file updates and other tasks
9) Proceed to step 1

The Security, Screen, and Activation Table subsystems are collected in the "Z" Screenbuilder. Screenbuilder requires the DBD subsystem, but the DBD subsystem is a logically independent component incorporated into other Information Associates products.

Z Run Time Components

These services fall into four categories: (1) Access control; (2) terminal handling; (3) Value constraint enforcement; (4) File processing and checkpoint/recovery.

Details of how these services work are not fully described in any publicly available Information Associates' document. Many of these services depend on Digital's VMS System Services: (QIO, RMS file sharing, Shared Global Sections and Mailboxes). The following specific services are provided by Z at run time. Next to each I have named the principle component(s) performing the service, but a detailed knowledge need only be acquired if you plan to make major extensions to Z/SIS.

- Z/SIS login processing - ZZLOGN
- Access control processing - ZZSCUR
- Procedure and Screen Fetch - ZZCNTL
- Procedure interpretation/subroutine dispatching -ZZCNTL
- Terminal handling - ZZUTIL, SYS$QIO
- Value constraint enforcement - ZZEDIT
- File input/output - ZAFLIO
- Input/output serialization - ZAFLIO, RMS file sharing
- File checkpointing/recovery - ZAFLIO, ZAC001, ZBA001

SIS Application Components

SIS subroutines carry out specific administrative tasks in an environment established by the Z utility. They contain application-specific logic paths which create and enforce correct inter-file relationships. For example, each student in the I.A. system is represented by a number of records in many files. Records in one file imply the existence of related records in other files. SIS logic enforces these implications.

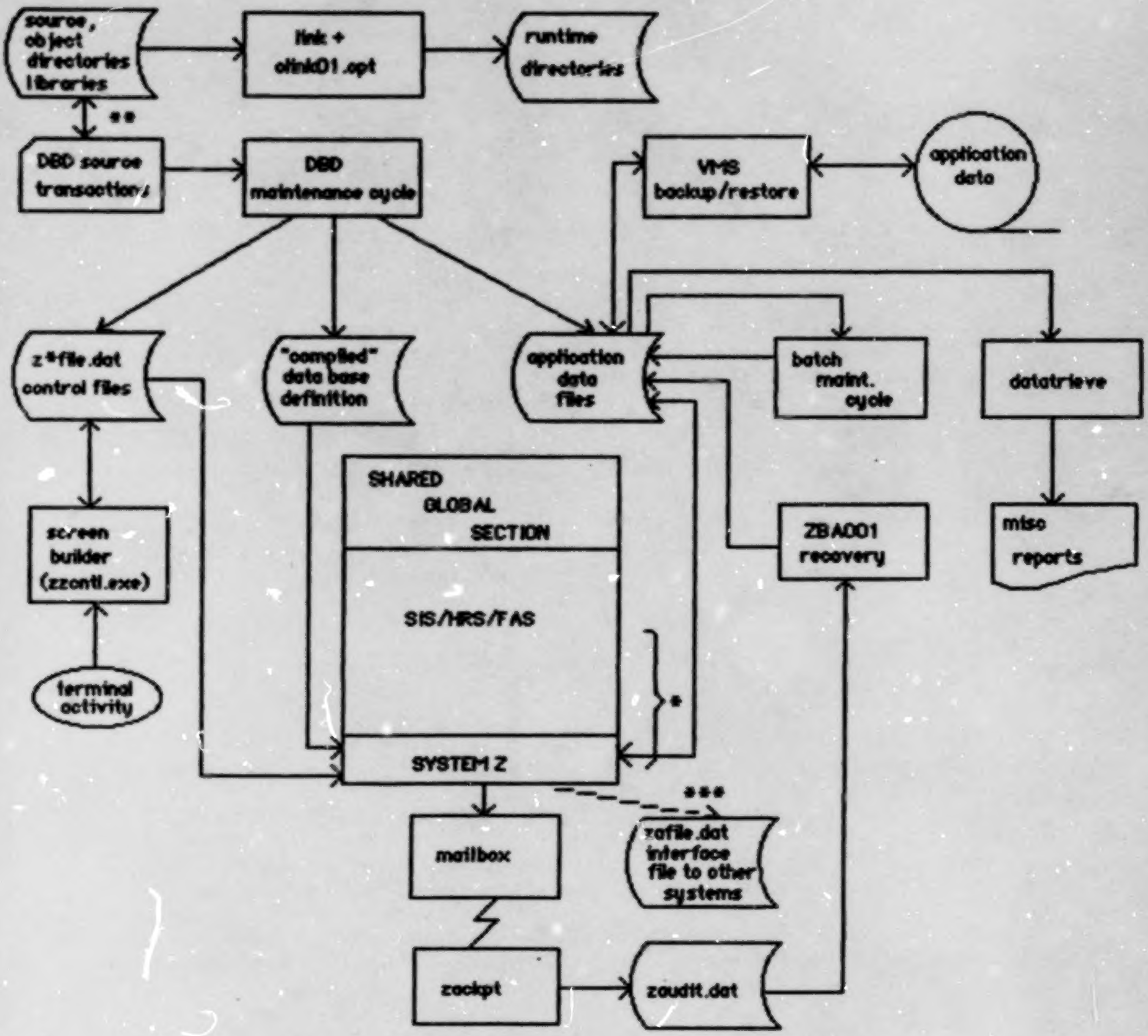
SIS System Definition Component. The single SIS component of this type is the DBD, the file of data descriptions which define user data in SIS.

SIS Run Time Components. Each SIS program performs a single user task. For example, one module generates transcripts, another defines courses, a third posts grades. Certain SIS programs are associated with individual data elements rather than with the entire screen. Special constraints based on relationships among disparate data elements may be enforced using these programs. In traditional systems, this kind of processing is usually found in the deepest recesses of the design. However, in Z/SIS, this code is clearly isolated and readily accessible for modification.

SIS application files. Excluding Z tables, twenty-four indexed files hold application values. Files are grouped by functional sub-system: Admissions, Financial Aid, Student Records, and Billing/Receivables. Each group is serviced by its own SIS file-interface program. This design means that the application designer may not freely access data residing in one file group with data in another. For example, a user who desires to create a screen showing data from Student Records and Admissions can only do this by making sure the data to be processed resides in a file common to both groups. This underlying restriction is a side-effect of the design of the SIS file interface modules. It is not a restriction inherent in the Z utility. Overcoming this restriction would repair what I feel is the most significant flaw in the SIS product.

The relationships between Z and SIS components are summarized in Diagram 3.

Z-SIS SYSTEM COMPONENTS & RELATIONSHIPS


source, object directories libraries
link + olink01.opt
runtime directories
**
DBD source transactions
DBD maintenance cycle
VMS backup/restore
application data
z*file.dat control files
"compiled" data base definition
application data files
batch maint. cycle
datatrieve
SHARED GLOBAL SECTION
SIS/HRS/FAS
SYSTEM Z
*
screen builder (zzcntl.exe)
terminal activity
ZBA001 recovery
misc reports
***
mailbox
zafile.dat interface file to other systems
zackpt
zaudit.dat

* Built by VMS link command + I-A. defined.opt files

** Non-automated relationship between DEs & filler

*** Optional

Diagram 3

BEST COPY AVAILABLE

Application Startup Tasks

These tasks will require 1.3 years to complete at Dartmouth. They require administrators who have complete knowledge of administrative practices and a programming group that is comfortable learning new techniques.

The work required to set up the standard SIS package consists of reviewing and revising data element definitions defined in the vendor-supplied prototype DBD subsystem. Other basic values stored in tables and in source code also require user attention.

In its current form, Z/SIS is designed to be used as delivered at institutions which:

- use the semester system
- calculate tuition as a function of a student's course enrollment
- monitor housing assignments using some other automated or manual system
- do not offer contract grading
- have an existing data control group to submit jobs and distribute output
- do manual degree and requirements auditing
- do not intend to introduce local modifications

If your institution does not fit this description, the amount of additional work required to make the system operational depends on the kinds of changes you wish to introduce. Changes can be categorized on a spectrum of increasing difficulty.

1. Changing screen formats, leaving data content unaltered.

2. Defining new values for existing data items.

3. Using unallocated record areas for locally defined data. This requires that you understand I.A. support policy regarding user-defined data. On the technical side, changes of this kind may require changes to Z/SIS programs and/or the creation of user-written programs.

Activities 1 - 3 will be readily supported by version 84.4 of Z/SIS, the first release to define a protocol for implementing user-defined data extensions.

4. Defining auxiliary files. This requires changes in categories 1 - 3 and requires coding I/O support for the new file. This modification requires advanced data processing skills to implement.

5. Using vendor-defined data space for local purposes. This involves 2 and 3 and introduces many ongoing problems. It requires de-activating vendor data and tracing the impact of the deactivation through the 300 odd modules of SIS. This practice sets up an ongoing conflict between the user and future I.A. product releases and should be avoided like the plague.

Z/SIS Setup

Setup activities can be described as I.A.-inherent or user-extension tasks -- indicated in the list by "***".

Admissions Setup Tasks.

(1) Revise data elements to define instructional programs.
(2) *** Capture SAT and local testing scores. This may not be a major issue in the community college setting, but it is a major concern at schools with admissions policies resembling Dartmouth's.
(3) *** Define additional student applicant data. These include family affiliations with the institution, sport skills and interviewer evaluations.
(4) *** Modify screens to provide windows for local data.
(5) *** Provide student lists ordered by locally-defined data values.
(6) *** Modify SAT tape load program to capture achievement scores.

Financial Aid Setup Tasks.

(1) *** Define additional financial status data.
(2) *** Define variant methods for computing financial aid awards.
(3) *** Acquire student employment data. These need to be reported throughout the student's academic career.
(4) Correct problems with Billing/Receivables interface with FAMS.

Student Records Setup Tasks.

(1) Define department, major, subject area, degree and other tables.
(2) Define the course catalog.
(3) Define the term-specific directories of classes.
(4) *** Define additional course attributes and course/term attributes to support requirements/degree audit.
(5) *** Define and implement enrollment projection data for each student.
(6) *** Define and implement additional/substitute reporting.
(7) *** Create historical data conversion programs and load historical students.
(8) *** Implement additional grading types using a protocol defined in Z/SIS.
(9) *** Modify section assignment logic in course drop/add function

Billing/Receivables Tasks.

(1) Define rate tables for all services offered by the institution: housing, fees, tuition and other costs.
(2) *** Simplify rate table structure and revise certain programs. For example, Z/SIS computes tuition based on actual student course enrollments. At Dartmouth, tuition is a function of student classification and is computed in advance of course enrollment.
(3) *** Isolate student from non-student billing. Inherent accounting differences require this separation at Dartmouth.
(4) *** Implement late and finance-charge calculations.

Other Startup Tasks.

(1) *** Define and implement a method to enable end-users to run selected batch job streams.
(2) *** Define and implement a housing management system and associated billing interfaces.

Evaluation of Z/SIS

Strengths

1. The operating environment, VAX 11/78x under VMS, provides many services that simplify Z/SIS coding and has enabled us to extend the system in complex ways. For example, object code produced by COBOL, PL/1 and MACRO can be linked into a single executable image. Other facilities such as mailboxes have proven extremely useful.

2. The Z utility and DBD subsystem support processing which would require monumental labor in a hard-coded system. The technician must follow a number of well documented restrictions when using these facilities. Release 84.4 and beyond will support concurrent changes from both Information Associates and the user community.

3. Z is an application generator. The logic of SIS has been simplified by using Z facilities. This permits SIS to include logic covering a wide span of user functions.

Weaknesses

1. Internal conventions related to SIS file handling have made development of some extensions difficult. The boundries between application file clusters create restrictions that require additional code to overcome. Disadvantages stemming from this restriction have been curtailed to some extent because one file does exist which is common to all groups and which can serve as a link common to all clusters. Also, the clusters that are supported do satisfy most user needs. Finally Information Associates is aware of the file cluster side effects and is working to overcome them.

2. Current SIS design assumes the existence of an established data control group to handle batch job submission and report distribution. These groups do not exist in small schools. The product needs but does not yet have one or more SIS screens supporting batch job submission.

3. Housing records managment is not covered by SIS. The student's dormitory room is recorded in student records, but the corresponding management of the dormitory room inventory is lacking.

Conclusion

Academic records management is laced with local conventions, codings and exceptions. A generalized software application must somehow accommodate this entrenched diversity. Admissions policies and requirements for graduation vary widely among institutions and over time, so any general solution must allow new data values to co-exist with old. In this context, the Z/SIS approach to student records is very well conceived.

SIS covers a wide span of student administrative functions. The 84.4 release defines a user data protocol which will support significant user data extensions and which will overcome most of the SIS file clustering side effects.

University of Nevada System
End User On-line Screen Design/Implementation

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The University of Nevada System (UNS) consists of two universities, four community colleges, a research institute, and the Chancellor's Office, which includes the system's computing center (UNSCC). The UNSCC student records administrative staff for development and maintenance for the six autonomous teaching institutions is three FTE.

UNSCC was faced with the all too frequent problem of providing on-line capability in student records with extremely limited resources and a diverse user population. In order to provide the on-line capability which minimized maintenance and maximized user utilization, software was developed that allows on-line screen design and implementation capabilities by the institutional end-user while retaining the centralized application control.

This paper will examine the development and implementation of the package and includes:

1. An overview of UNS and UNSCC
2. Brief analysis of the on-line needs and constraints
3. The solution from both the user and UNSCC perspective

UNIVERSITY OF NEVADA

The University of Nevada is a diverse higher educational system. It includes seven autonomous institutions and the Chancellor's Office. Specifically these are:

1. Two Universities: Reno and Las Vegas
2. Four Community Colleges: Clark County (Las Vegas), Northern Nevada (Elko), Truckee Meadows (Reno), and Western Nevada (Carson City).
3. Desert Research Institute (Reno-Las Vegas)
4. Chancellor's Office

In addition, given the geography and the population structure of Nevada, each community college consists of additional campuses and/or rural centers distributed throughout the state. The academic programs for the institutions include such diverse areas as Medicine, Agriculture and Business. Degrees range from MD to Ph.D's in Engineering, Physics, English and other fields, to an Associate in Applied Science and Diesel Mechanics, Farm and Ranch Management, Office Administration, and other fields. These programs serve more than 40,000 students throughout the state with just over one-half at the University level.

SYSTEM COMPUTING CENTER (UNSCC)

While each institution maintains its autonomy in programs and procedures there is a need for system-wide coordination, administration, and services. The Chancellor's Office under the direction of an elected governing board (Board of Regents) is responsible for fulfilling that role. Under the administrative jurisdiction of the Chancellor's Office, the System Computer Center is charged with providing computing services to all components of the University of Nevada System. The primary responsibility of UNSCC is to provide computing support for education, research, and administrative objectives of the University of Nevada.

To carry out these responsibilities, UNSCC has established two Centers of Excellence - one to focus on and serve the academic needs of the UNS, the other to focus on and serve the administrative needs of UNS. These Centers of excellence are located in Las Vegas and Reno respectively. Furthermore, there are a number of remote batch terminal and mini-computer sights distributed throughout the state. Organizationally in addition to the academic and administrative areas supported through the Centers of Excellence, UNSCC includes operational support at both the Las Vegas and Reno facilities as well as telecommunications network support state-wide.

Given the focus of this paper, additional information concerning the administrative area is appropriate. Administrative support for the University of Nevada from UNSCC includes both development and maintenance for seven institutions and the Chancellor's Office in five major categories.

1. Student
2. Financial
3. Human Resources (Payroll/Personnel)
4. Facilities
5. Library

To carry out the responsibilities in this area, the Assistant Director of Administrative Systems has a staff of 11 Analyst/Programmers divided among the various applications which includes three in the student area.

PROBLEM STATEMENT

UNSCC administrative systems, as in most institutions, began in the student records and financial areas and were developed and maintained as batch oriented systems. As administrative applications diversified and institutions grew, computer resources, both staff and equipment, remained relatively stable. Under these circumstances, a batch oriented environment was easily the most cost effective and efficient method to provide computing services state-wide from a central facility.

Recent years have, however, produced a number of changes. These include:

1. Considerable equipment growth, both within UNSCC and on the individual campuses.

2. An ever increasing demand and need for more information, specifically more timely information, in virtually all aspects of institutional administration. Several factors contribute to this point. They include:

   a) Increasing calls for accountability by external agencies.

b) Increasing tasks and functions attributed to the institutions without increased staff.

c) Particularly in Nevada, significant enrollment growth in the latter part of the 1970's and early 1980's, followed by leveling or declining enrollment.

d) Tightening financial considerations.

3. The rapid growth and expansion of computer access/interfaces in everyday life.

These three factors have contributed to an increase in computer awareness and an increased need for a more timely and constant presence of computer resources in the administrative areas. In view of these changes, the need for moving UNS into an on-line environment for many administrative applications became more and more pressing. However, given the diversity of the system, the scope of the responsibility in the administrative area, the geography and population of the state and the available staff, the need for innovation was clear.

The problem then was to provide the University of Nevada System with an on-line environment which:

1. Would be centrally developed and maintained to allow for database control and integrity.

2. Allowed for campus autonomy and campus-level development at differing rates for each institution within the system.

3. Stayed within available personnel and computer resources.

Several possible options were available for this task. These included:

1. Either by mandate or consensus, standardization of screens and procedures with central program control and development.

   This option was not considered to be realistic for several reasons. Given the autonomous nature and structure of the system, mandated standardization was not viewed as an acceptable option to present to the campuses. Furthermore, given the diversity and complexity of the institutions involved, the likelihood of a consensus (let alone a timely consensus) at the level of detail necessary for such a task was also not considered to be realistic. Finally, this option severely limited individual user flexibility and would have placed unreasonable constraints on the individual campuses.

2. The use of third-party application packages and/or generative software packages by each campus and the Chancellor's Office for their own development.

   This second option, while maximizing campus autonomy, was not considered to be realistic. Two major factors contributed to this. The first is that such an approach is inconsistent within the overall organization structure of the University of Nevada System. The second and related reason is that campuses are not currently organized or staffed to undertake such a task on an individual basis. This appears to be due primarily to budget constraints.

Given the problem as described, a third option was chosen which incorporates and enhances the advantages of the two options while minimizing the disadvantages.

SOLUTION

To provide such a package, the Screen Inquiry System (SIS) was developed by the System Computing Center. While SIS maintains the integrity of the DataBase, each institution has a SIS coordinator that is responsible for the definition and implementation of screens and controlling the access to the DataBase. The three major functions in SIS are:

1. Screen Definition - The process of installing new screens or modifying existing screens for the institution.

2. Operator Validation - The process of establishing operator names and passwords for access to the system and identifying each screen the operator is validated to use.

3. User Access - The actual use of the screens by the operators.

Screen Definition

Implementation of a new screen or maintenance of an existing screen is the responsibility and is performed on line exclusively by each of the SIS coordinators at the institutions. There is no direct contact necessary with any of the Computing Center personnel nor is the current usage of the system a concern. The information required to generate a screen is maintained in a parameter table file which consists of:

1. Screen Name - a period (.) followed by a user defined name of up to seven characters.

2. Screen Title - up to 20 characters that is also defined by the user for descriptive purposes only. It is not displayed as part of the screen unless explicitly defined by the user in the screen detail.

3. Access Type - Defines the initial path into the Data Base, e.g., student, course, etc., and is selected by the user depending on the function of the screen. There may be multiple prompt types from which the coordinator can select. For example, a screen that is accessed thru the student path can be defined to prompt and accept only student I.D. numbers, student names, or either. The type of prompt for the semester is also selected. It can be set to prompt for each access of the screen or to default to the current term for the institution with no prompt.

4. Detail Information - This is the actual definition of what goes where on the screen. By specifying a line number (row) and a position number (column), the coordinator selects one of the following types of information:

    a. Literal - a constant that does not change its value and is used on screens for titles, heading, etc. A literal of any value can be displayed anywhere on a screen.

    b. Data Element - using an abbreviation (mnemonic), any element in the DataBase can be selected. Editing characteristics are also invoked as applicable and can be overridden as desired. For example, a date can be displayed as 12-07-84 or as 120784.

c. Code Description - certain data elements are coded and controlled with a code definition table which also contains a description of the value. For example, the description "RESIDENT" can be displayed for Residency Code "N".

d. Calculated Value - some data does not physically exist on the DataBase but can be derived internally from other elements (e.g., GPA, number of credits a student is currently enrolled in, etc.) By using an abbreviation, any of the defined calculated values can be displayed on the screen.

e. Get Next Record - On the DataBase, there may be a one to many relationship. For example, a student may be enrolled in more than one class or a class may have more than one student enrolled. This is used to specify that the next logical record in the Data Base should be loaded and used in the generation for the remainder of the screen.

f. Check for Continuation - Because of physical screen limits, all of the data for a screen may not be displayed on a single screen. When there is more data for the screen, a specified literal is displayed and the user will be prompted that there is more data. If desired, the operator can view the remainder of the screen.

Operator Validation

The SIS coordinator is also responsible for defining who can use the system and which screens they are validated to use. As in the case of the Screen Definition, the Operator Validation maintenance is performed on-line and there is no direct contact with the Computing Center nor is the current usage of the system a concern. The information is maintained in a parameter table file which consists of:

1. Operator Identification - Once a user has a connection into SIS, an operator name and password must be entered and each consists of up to seven characters. The SIS coordinator assigns and maintains these codes.

2. Screen Authorization - Each operator can be authorized to use up to 100 different screens that have been implemented for the institution. The screen names must be explicitly specified for each operator. If desired, additional restrictions can be imposed for each screen that an operator is validated to use. This process consists of defining which type of data can be viewed. After the operator has entered the prompt information, restrictions are checked and if they are outside the range, no values from the DataBase are displayed on the screen. For example, the Electrical Engineering department is authorized for a class list screen but is restricted to viewing only Electrical Engineering classes. If a class is entered that is not in the department, the screen is returned with blanks where the DataBase information would normally appear on the screen.

User Access

Once the coordinator at an institution has defined screens and validated operators, SIS is used as follows:

1. System Log-in - Each institution has a unique account number and password. The account is only validated for the SIS application and no other functions can be executed within the account. This prevents on-line "browsing" of files using an editor (although there are other ramifications that make it difficult to look at files anyway), making a copy of a file, or any other function outside the control of SIS.

2. Operator Validation - Once validated as a legal system user, a name and password must be entered as assigned by the SIS coordinator and as maintained in the Operator Validation file. After 3 unsuccessful tries, the terminal is logged-out and the line dropped.

3. Operator Access Control - When a valid name and password is entered, the Operator Validation file is also used to identify screens and any access restrictions for the operator. The Screen Definition file is accessed and the information required to generate each screen is attached to the user for the duration of their session.

4. Screen Prompt - If the user is authorized for more than one screen, a prompt for the desired screen name is sent. All screen names are preceded by a period (.) so

as to be unique from other information that may be entered, such as a student name. At any point in the session, a new screen may be accessed by entering the period and the screen name.

5. Key Prompt - To display a screen, a prompt is sent for a key value that is appropriate for the data that will be displayed. For example, a class list screen would require a class identification, a student screen would require a student identification. The actual types of keys are established by the SIS coordinator when the screen is developed. After the response to the prompt is received and edited for proper format, the screen is displayed and is followed by the prompt for the screen. The user can respond with a new key value or can enter a new screen name which results in a key prompt for the new screen.

   Besides actual data, there are other values that have significance as responses to key prompts.

   a. An asterisk (*) is used to repeat the last key value and is used mainly when changing screens. For example, a student, John Doe, is currently displayed on screen "A" and it is desired to view the same student on the "B" screen. ".B" would be entered to switch screens and "*" for the response to the Key prompt. John Doe would then be displayed using the "B" screen.

   b. A plus (+) is entered to display the next sequential group of data. For example, if class #1 is currently displayed, entering "+" would cause class #2 to be displayed.

   c. A dash (-) can be entered when applicable to continue (page) a screen. For example, a class list screen has been set-up to display up to 20 students per screen. A dash (-) can be entered after the first 20 students are displayed to view the next 20 or any other valid response can be entered to view another class, switch to a different screen, etc.

6. Executive Commands - An additional set of instructions can be entered at any point in the dialog past the validation steps. Once the command has been processed, the dialog is continued at the point where the executive command was entered. All executive commands are

preceded by a dollar sign ($) so as not to be confused with data. Functions include the following:

a. $MENU lists the screen names, titles, and key prompts for each screen the operator is authorized to use.

b. $FILES lists the DataBase status as to when each file was created on disk from the tape master.

c. $STATUS lists information regarding the current status of SIS and the user's session. For example, the number of current SIS users, the values of the current keys and the default term semester code, etc.

d. $TERM is used to change the value of the default term semester code for the user (it does not affect any other users)

e. $BYE is used to log-off the system.

f. $MSG is available only to the SIS coordinator and can be used to broadcast a message to any users at their institution.

CONCLUSION

SIS allows on-line access to the DataBase with user defined and user implemented screen formats. In addition, the user is responsible for who can access the DataBase and for how it is viewed. New screens can be implemented or existing screens modified on-line by the user without any involvement by the Computing Center personnel and without regard to the current usage of the system. There are no programs that need to be modified and compiled by an Analyst/Programmer. The Computer Center need only be concerned with the structure and integrity of the DataBase.

Given the problem, as defined, the identified needs, and the available options, the concepts developed and implemented in SIS have become an effective and practical tool to bring the University of Nevada System into an on-line environment.

COMPANY PARTICIPATION

Twenty-two companies with computer-related products and services participated in the CAUSE National Conference (see page 618) through company presentations, sponsorships of conference activities, company hospitality, and suite exhibits. In addition to the support of these companies, CAUSE appreciated the donation by Sperry Computer Systems of a discount coupon for each conferee for EPCOT Center to be used following CAUSE84, as well as the presentations on EPCOT Center made by Dr. Edward Lias of Sperry before and during the conference.

PARTICIPATING COMPANIES

CAUSE appreciates company participation in the CAUSE National Conference. The following companies contributed to the success of CAUSE84:

American Management Systems, Inc. (3,4)

ARCHON Computer Solutions, Inc./Microdata Corporation (3,4)

Burroughs Corporation (1)

Business Information Technology (2)

Cincom Systems, Inc. (1)

Control Data Corporation (1,3,4)

Coopers & Lybrand (1,2)

Corvus Systems (1,3,4)

Datatel Minicomputer Company (3,4)

Digital Equipment Corporation (1,2,3)

Hewlett-Packard Company (2)

IBM Corporation (1,3)

Information Associates (1,2,3,4)

Integral Systems, Inc. (1,3,4)

Martin Marietta Data Systems (2,3)

Peat, Marwick, Mitchell & Co. (1,2)

PR1ME Computer, Inc. (1,2,3,4)

ROLM Corporation (1)

Sperry Corporation Computer Systems (3,4)

Systems & Computer Technology Corporation (1,2,3,4)

Texas Instruments (1,3,4)

Wang Laboratories (1)

KEY:
1 Presentation
2 Sponsorship
3 Suite Exhibit
4 Hospitality

Company Presentations

Coordinator:
Gary D. Devine
University of Colorado

Lynn Van Buren
Information Associates

Tom McLean
Cincom Systems

John Alden
Texas Instruments

FOURTH GENERATION LANGUAGES: THE PRODUCTIVITY CENTER

THE COMPUTER INDUSTRY TODAY

The computer industry today is characterized by three main entities all attempting to address the information needs of an organization. These three areas are traditional data processing, the micro-computers, and the information center approach. If these are all managed separately, there will be a redundancy of hardware and staff resources as well as a confusion to end users. It is of utmost importance to ensure that these three areas are managed together and cohesively combined to form what Burroughs terms as a Productivity Center.

THE PRODUCTIVITY CENTER

The Productivity Center has the following characteristics:

- Uses fourth generation tools to speed development
- End-User tools for inquiry and reporting on real-time databases
- Easy interfaces for micros to mainframes
- Centralizes information access and control
- Avoids duplication of resources
- Reduces lead time for business solutions

FOURTH GENERATION LANGUAGES

The fourth generation of software languages is a new revolution occurring in the industry. The second generation was primarily Assembly language. The third generation included COBOL, FORTRAN, RPG, etc. Fourth generation languages allow a user to obtain results in one tenth the time of COBOL, or less. Fourth generation has become a widely used term encompassing many types of products:

- PC Tools
- Query Languages, Report Generators
- Graphics Generators
- Decision Support, Financial Modeling
- Application Generators Suitable for End Users
- Application Generators Primarily for DP Professionals

When comparing different fourth generation products, one must understand what category each product addresses. For instance, comparing a query language with an application generator is not appropriate because they address different needs.

EVALUATING PRODUCTIVITY AND ESTIMATING PROJECT SIZE

Function Point Analysis is a technique designed by Allen Albrecht of IBM to measure developmental productivity and to estimate project size. Function Point Analysis (FPA) is a methodology an analyst will use to determine the scope of an application system. Unlike other techniques available, (counting lines of source code or Halstead Metrics) FPA is computer language independent and analyzes the application from a user functionality perspective. The analyst will calculate the number of functions delivered to the end user based on the following categories:

- User Inputs
- User Outputs
- User Inquiries
- Master Files
- Interfaces to Other Systems

Different weights are assigned to each function depending on the amount of data and complexity required. The FPA technique can be learned in a few days, (Burroughs offers a course for anyone interested) and takes a few hours or more to analyze an application from the user requirements or design documents. A side benefit from doing a function point study on an application project is it forces the analyst to look at the application from the user perspective which may uncover missed functions earlier in the project.

BURROUGHS FOURTH GENERATION LANGUAGE - LINC

Burroughs LINC, Logic Information Network Compiler is one of the more sophisticated fourth generation languages available on the market today. LINC falls into the category of fourth generation languages primarily for DP professionals with a subset of the language useable by end users. LINC capabilities include:

- Automates the database, network, and program design of a business problem
- Creates on-line, transaction oriented application systems
- Provides extensive prototyping capabilities
- Supports inquiry, reporting, and batch facilities
- Eliminates need for any COBOL coding
- Generates standard Burroughs network language, database language, and COBOL 74 programs
- Encourages high end-user involvement during entire development process
- Provides dramatic productivity in developing complete application systems
- Utilizes a business oriented design resulting in a common language for analysts and users
- Interfaces to other Burroughs proudcts for ad-hoc query and report generation

SUMMARY

We are in the midst of a dramatic change in the way we develop application systems. This change is similiar in nature to the move from Assembler to COBOL. The more global thinkers will embrace the concept and move forward. Other people will fight the change, not wanting to let go of their hard-earned technial skills. But one thing is for sure - it will happen and it will have a signficant impact on the ability of data processing to meet the changing information demands of an organization.

CONTROL DATA

CAUSE 1984: Proceedings Submission

Computer Systems for Higher Education — Your Single Source for an Integrated Computing Facility

Control Data enables your institution to assemble computing facilities that will serve the students, faculty and administration today and insure growth capacity for tomorrow's expanded needs. Control Data's commitment to higher education incorporates traditional computing requirements, continues to provide innovation in the field of computer based education and now includes administrative applications for the campus management team.

Computers

Control Data's computers are the most powerful, versatile machines available for campuses today. These computers include the CYBER 205 super computer, large and medium scale CYBER 180 Series 800 to microcomputers. The CYBER operating system, NOS, supports most commonly used, high level languages as well as graphics, data base management and a great number of application programs.

Computer-based Education

PLATO, the standard bearer for computer based education, includes thousands of hours of courseware for such disciplines as the sciences, engineering, humanities, math and nursing. PLATO is not simply a "package" of hardware or courseware—its an amazingly versatile concept that lets you choose the course material and the delivery method that will solve your problem in the most convenient, cost effective manner

Administrative Applications

The Eden System is a comprehensive administrative software product designed to support the campus management team. Its four unique building blocks include student records, business and finance, payroll and personnel and budget forecasting. All modules are integrated to maximize the efficiency and effectiveness of the administrative processes at your institution.

Control Data offers an array of support services which in part include:

- consultation by education and computing specialists;
- training for data processing staff, faculty and administrators;
- cooperative application development programs;
- information exchange;
- world-wide educational users group;
- equipment and software maintenance.

These services are but examples of the assistance and support available to Control Data customers. Your institution has the added comfort of knowing that Control Data, a $4.6 billion computer and financial services company with operations in 47 countries, is committed to education—it is a pillar of the corporate strategy. You can be confident of continued innovation and support in the years to come.

Control Data's success is in large part attributable to the way our people apply themselves to solving problems for customers—to making certain that our systems and services meet and continue to meet the needs of higher education. Our hardware and software have been designed to accommodate your growth. They're systems solutions for the 1990's and beyond.

Let us tell you more about the solutions Control Data has for your data processing needs. For additional information, contact your local Control Data representative or write to:

Control Data Corporation
HQW09A
P.O. Box 0
Minneapolis, Minnesota 55440

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In our presentation to CAUSE members on December 5, 1984, the message was: top management must become increasingly involved in the planning and use of information/telecommunications services. The momentous changes in the structure and regulation of the telecommunications industry, coupled with rapidly advancing technology, are multiplying and complicating the choices and selection process for users. At the same time, telecommunications and, more broadly, the information infrastructure are playing an increasingly pivotal role in operating an educational institution and in shaping and delivering educational programs.

The telecommunications industry is in the midst of massive changes that are transforming supplier/user relationships. The Bell System as we knew it two years ago -- a single entity able to meet all of a user's telecommunications needs -- is gone. Like it or not, users must deal with a multi-vendor environment. Moreover, competitors have made serious inroads into market segments traditionally dominated by AT&T. At the same time, suppliers are crossing traditional boundaries to enter new markets through alliances and acquisitions and new products. For example, IBM, through its full ownership of Rolm Corp. and 60% share of SBS, is squarely in the telecommunications business, while AT&T's arrangements with Olivetti and Convergent Technologies are aimed at strengthening AT&T's position in office automation and computers.

The outlook for users includes: no easy choices (and no more one-stop shopping) and continued confusion as the telecommunications industry adjusts to its emerging stucture and remaining inconsistencies. The challenge for users is to remain keenly aware of major events and trends and to develop a gameplan.

Many have written much about the mind-boggling advances in technology and the tremendous proliferation of products spawned by them. The botton line is that, on one level, appliances/devices have become smarter, cheaper and smaller and, thus, more professionals have them -- and, increasingly, want them to "communicate" with other appliances and resources. On another level, there have been major advances in the technologies that can be applied to enable -- and hasten -- that communication. Again, the implication for users is closer attention and careful planning.

On campus, the user community is expanding in size, scope and sophistication. Like commercial enterprises, educational institutions have planned and managed telecommunications, information systems and office services separately and at varying, and often low, levels of the organization. That must change -- top management must get involved and planning and management of information-related services must be unified.

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CORVUS

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Networking Personal Computers

by Bruce Eisenhard
Corvus Systems

So far, personal computers have not been integrated into any overall system for office automation. And, they haven't been integrated into the data processing batch oriented environment. Until now, personal computer users and the DP managers have been at odds (although they should complement one another) with the DP section serving as the "reliable" data storehouse allowing the personal computer on-line access.

Local area networks (LANs) will be the key to any form of truly productive office automation or distributed processing. In many cases, the hardware for these systems now exists on the market as commercial LANs have been available for more than three years.

Broadband and Baseband Networks

There are already a number of LAN products on the market. They are currently competing but to a large extent, they'll become complementary in the evolution of final solutions to the office automation problem.

One of the primary distinctions in existing LANs is broadband and baseband products. A baseband network is a single channel implementation. Broadband networks provide multiple channels and accommodate dissimilar types of information, carrying voice, data, and video on separate bands. These two technologies can enhance each other because broadband nets can function as trunks for a variety of baseband networks.

Tradeoffs

The implementation of the network's physical layer has several tradeoffs including cost, speed, distance and number of nodes. The speed of the network determines the requirements for the transceivers, transmission media, distance limits, and level of service at the host. Higher speed implies higher cost transceivers and more performance required with the processor handling the network interface.

The media, as well, affects the relationship of speed and distance. Twisted pair cable is good for low to moderate speed networks over moderate distances (approx. 1 km). Thin coax can run at higher speeds for moderate to high speed nets over shorter distances. Thicker coax can extend the distance or speed. The more nodes, the more expensive the transceivers or increased requirements for network repeaters (amplifiers). More nodes imply a need for higher bandwidth.

These tradeoffs all impact the cost of the network. Of course, that's making the assumption that the cost of the interface should be compatible with the cost of the equipment to be connected.

Corvus Systems introduced Omninet™ in 1981. It was designed specifically for the needs of the personal computer user in the office. Because of its good match to the market over 150,000 nodes have been connected. This is more than all other networks combined.

Hidden Costs

Many networking costs are hidden from the consumer if the retail price of the interface is the only item considered. In fact, the interface price tag may only be a fraction of the cost of network installation. Cabling can be a major expense if the cable is coax and especially CATV coax which requires professional installation.

One of the main attractions of networks using twisted pair cable like Omninet is that the connections can be made easily without specialized tools. Personal computer users are traditionally not computer professionals. Networks must be made easy to use, install, and maintain, or they'll find difficulty gaining market acceptance.

Corvus was the first company to include a processor in the basic network interface. This has reduced the requirement for software in the host processor and increased the relative performance of the network. The reduced software burden has also made Omninet easier to port to new systems and Omninet is available on a wider variety of personal computers than any other network.

Network Usage

The use of the network has a direct impact on its cost and productivity. In smaller networks, resource sharing is one of the major needs the network is built to satisfy. Personal computers in business require a large investment in peripherals if they're to be stand alone machines. A minimum hardware configuration consists of a large amount of RAM, at least one floppy, a Winchester disk, and a printer—at the cost of $10,000. LANs can have a major impact on the per user cost of computing by allowing shared access to the printer, disks, and backup.

Resource sharing has a number of advantages for a LAN. The cost per node can be decreased and more complex peripheral services can be offered to the network users sharing in the cost.

Corvus' Omninet has a 1 megabit bandwidth which seems adequate for a network composed of personal computers. Applications can be divided into the client-server and the peer-to-peer dialog. In resource sharing, the client-server mode is predominant.

Corvus experience seems to indicate that one disk can serve between 20 and 30 users before response time starts to degenerate. The degradation is caused by a limit of the server related to seek and latency times of the disk-server. When heavily loaded the network seems to be only about 15 percent utilitized as users are queued up waiting service from the server. Peer-to-peer communication can saturate any network when taken to extremes, but when the source of that traffic is human-generated, the network utilization is quite low and bursty.

Hierachical Nets

There is no one network that will connect 10,000 users over a 40 square mile area with high bandwidth service and a connection cost of $100. Each of the networks has been optimized for only one of these parameters. The best way to approach a combination of these needs is with a combination of networks.

Broadband networks are the obvious candidates for functioning as trunks or backbones for a hierarchy of networks. Lower cost baseband networks would branch from the broadband trunk to service the majority of nodes. The advantage to this approach is that the connect cost of a node to the network is relatively low and the cost of the trunk can be amortized over many stations.

Within most businesses, there are "communities" of interest which normally contain individual company departments. Information exchange within these communities is frequent while communication to other parts of the company is much less frequent. In many cases, it may be desirable to protect information from access outside the group. Security can be difficult if all individuals within a company have access to all nodes of the network. When networks are departmentalized, security is easier as the connection to the trunk can be controlled within the department and access can be filtered from outside users.

Hierarchies of networks also provide other benefits over single networks. Within the hierarchy, there is a great deal of parallelism which contributes to increased throughput and reliability. The hierarchy can also be grown in increments to meet a wider variety of needs.

Networking in the Future

Timesharing schemes with clusters of terminals connected to minicomputers will be pushed out of the market by networked personal computers because of their higher performance possibilities. Servers may also be implemented using minicomputers to provide more reliable storage, high performance service, the wide variety of devices available on mini's, and as gateways to other networks.

Before truly productive networking can become a reality, several current problems must be worked out. As of this date, there is little software available that takes advantage of networks. Part and parcel of this issue is that there was no operating system support for personal computers in networking until the recent introduction of Microsoft Networks.

The need for standards is especially serious at the higher levels. Applications software for networks can now be written with less burden for portability placed on the software vendors. Too much effort is being placed on standardization at the very low levels.

There's no doubt that a need for standards exists but at the current rate, it appears the market will serve to define the standards instead of the committees.

Software tools for many office functions have been developed but few software vendors have addressed the needs of shared access in a network environment. (Hardware vendors can only provide so much help because they're limited in the number of changes that can be made to an operating system. If the changes are too extensive the systems become incompatible with the more popular end user programs.) Changes in the software market are finally in view and the firms that react the fastest will be able to capture this fast growth business.

Contact Jim Melin, 800-4-CORVUS for more information.

Omninet™ is a trademark of Corvus Systems, Inc.

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COLLEAGUE*
An Integrated Administrative Computer System

COMPANY PROFILE

COLLEAGUE is a product of Datatel, Inc. of Alexandria, Virginia. Datatel, organized in 1968, has installed over 300 minicomputer systems and has acquired over 500 customers in various industries throughout the United States. The company employs both technical and industry experts who provide services to colleges an universities across the country.

COLLEAGUE APPLICATION SOFTWARE

COLLEAGUE was specifically designed and developed by Datatel to meet the current and future needs of higher education institutions. Its development has over 50 man-years of effort behind it. After extensive testing Datatel installed its first system in 1979. Currently, COLLEAGUE is being used by more than 40 colleges and universities across the United States.

COLLEAGUE contains sixteen separate program modules, each of which is a comprehensive application for a specific administrative area such as Admissions, Registrar, Financial Aid, Alumni/Development, General Ledger, Purchasing, etc. Because each of COLLEAGUE's modules are fully integrated, once an information entry is made all users can simultaneously access the system. Although COLLEAGUE allows access of this data to all other areas and modules, security built into the system maintains the confidentiality of information contained in each module against unauthorized access.

The "base" COLLEAGUE package consists of ten (10) modules:

Admissions
Registrar
Financial Aid
Alumni/Development
Personnel
Purchasing
Accounts Payable
Accounts Receivable
Cash Receipts
General Ledger

The "optional" COLLEAGUE modules include the following:

Payroll
Student Affairs/Housing
Inventory
Fixed Assets
Physical Plant Work Order
Continuing Education

Unique to Colleges and Universities

Because no two schools are alike, COLLEAGUE is engineered for flexibility to meet requirements unique to each campus. COLLEAGUE was designed exclusively for use by colleges and universities. The business of running a campus requires cost efficient actions and creative long-range planning. COLLEAGUE makes this critical job a controlled part of your day-to-day operation. COLLEAGUE will serve an institution with a student body numbering less than a thousand or a large university. Public and private and two-year and four-year institutions across the United States presently enjoy the cost-effective benefits COLLEAGUE has brought to their campuses.

Greater Financial Awareness

COLLEAGUE incorporates NACUBO principles to create true fund accounting capabilities for your institution. You define your account number structure and then enter these to create your COLLEAGUE chart-of-accounts. Encumbrances, month to date, and year to date balances are maintained by the system so that a true financial outlook can be easily obtained. The flexible financial statement processor allows you to design reports to fit your financial reporting and analysis needs.

Record Student Activity

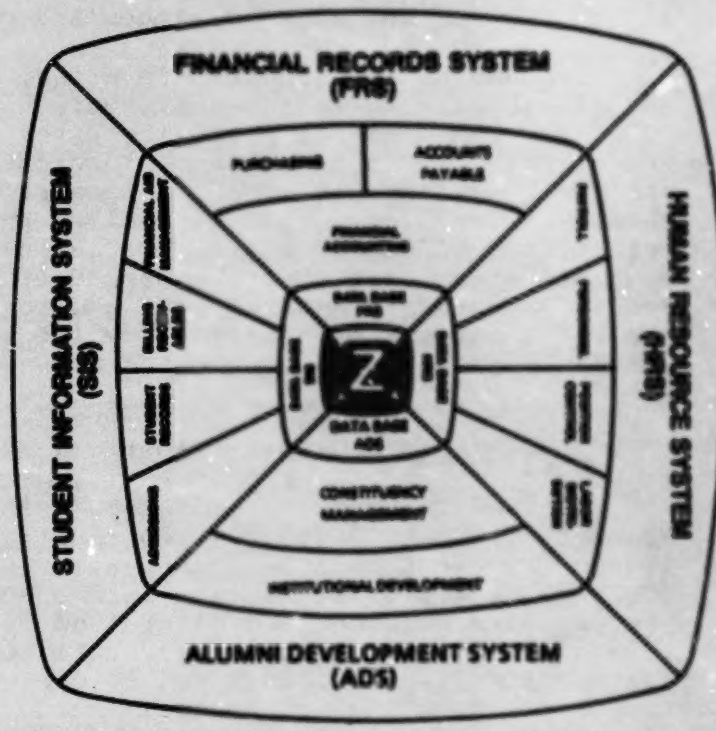
COLLEAGUE's student records applications, including Admissions, Registrar, Alumni/Development, Financial Aid, Student Affairs/Housing, and Continuing Education have been engineered so that each application is integrated. That means information is entered into the system once, and is available, with protections, to all appropriate offices. For example, a change in a student's status is immediately available to all affected administrative offices. Advisors can react, financial aid can be re-evaluated or registration may be impacted.

For more information contact:

Datatel, Inc.
3700 Mt. Vernon Avenue
Alexandria, Virginia 22305
(703) 549-4300

SERIES Ƶ: GENERAL CHARACTERISTICS AND FEATURES

A proven system for today's information management needs.



Series Ƶ is an integrated, on-line software system designed specifically to meet the information management needs of colleges and universities. Incorporating proven concepts from our years of experience with colleges and universities, we've created an affordable system for today's mini and mainframe computers.

Series Ƶ is actually four application systems in one: Financial Records, Human Resource, Student Information, and Alumni Development. All four systems interact with each other. Most of all, however, Series Ƶ provides you with all the information you need to make timely, accurate, intelligent management decisions.

Series Ƶ incorporates an integrated system structure to efficiently handle separate categories of processing, yet address the entire administrative needs of the institution. The Series Ƶ design eliminates data redundancy and promotes efficient processing.

A modular approach to design and integration has been applied. Such design permits 1) phased implementation allowing systems to be added as necessary and within the priorities of the institution, 2) modular sequence flexibility, 3) elimination of data redundancy, 4) a consistent data definition to be maintained as well as system integrity and security, 5) insulation from computing environment changes, and 6) continued development of modules to meet the higher education administration computing needs.

Series Ƶ Data Handler

The Series Ƶ Data Handler controls the storage of data and defines how that data will be integrated. The Data Handler functions as a Data Base Manager for the Series Ƶ administrative programs, integrates with other Data Base Manager Systems or with other non-Series Ƶ application programs. The Data Handler also controls screen formats, and procedures and enables the user to quickly make changes within the system, often without reprogramming.

Security

Series Z has been designed to "police" your information and let you control who sees what. The various levels of security control include: system, application, function or data element or the institution can define special access for limited use. Series Ƶ also defines on-line changes according to security levels in the same fashion.

On-Line Data Entry, Inquiry and Update

Input to Series Ƶ goes through a single channel, regardless of date, quantity or sequence. This includes both initial data entry and update of those data. All entries can be submitted in on-line, or in batches. Series Ƶ also provides for on-line inquiry to the data base, at any time.

Screen Generation/ Modification

Series Ƶ permits you to build your own screens, to meet possible user-defined needs not already addressed by the system.

On-Line Help

On-line help features include diagnostic, data definition and screen help. Series Ƶ is designed with such on-line features to assist the user or operator in learning how to use the system faster without the need to consult a manual or leave the terminal.

Software Maintenance

An important aspect of any software purchase is the availability of maintenance. Series Ƶ has a complete maintenance program for regulatory changes and/or enhancements.

Series Ƶ Report Writer

Ƶ Writer efficiently meets the report generation needs of Series Ƶ users. From the simple to the complex, Ƶ Writer is ready to provide the solutions to your ad-hoc reporting and on-demand data needs.

IA Prototypes

We've added a telephone registration system which enables students to register for their classes from a touch-tone telephone, any time of the day or night, from anywhere in the world.

The system, which uses telephone data entry and voice response, lets students register for all their courses in a matter of minutes, and even tells them if a course is full or otherwise unavailable.

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OAS- IA's Office Accounting System allows the end user to operate his microcomputer to track expenses as incurred and commitments as recognized. The purpose of OAS is to replace "desk-drawer" accounting and provide departments with a tool to uniformly monitor account balances and related commitments and expenditures. With OAS, the user can operate in a well-informed, more responsible and accountable manner.

IA Microcomputer Offerings

Information Associates has always provided higher education administration with labor-saving, state-of-the art software to assist in meeting administrative responsibilities. IA now offers FBS, a top down budgeting vehicle which allows your personal computer and mainframe to work together to build your budget. IA's Financial Budgeting System supports the entire budget process, producing a sound, workable document.

A Leader in Information Services

Our capabilities are backed by a staff of more than 150 professionals who concentrate on every element of each customer's individual requirements.

We are dedicated to seeking better solutions to turn data into useful information. We offer a full range of support services including customer training, user group participation, the necessary documentation, source code, test data, software maintenance and technical support.

Our experience and success in providing flexible, state-of-the-art systems makes us confident that Information Associates has such a system to meet your needs

Whether you're improving your present system, or just beginning to look for administrative software, investigate Series Ƶ first. Call the Information Associates office nearest you.

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3000 Ridge Road East
Rochester, New York 14622
(716) 467-7740

9491 Ridgehaven Court
San Diego, CA 92123
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Information Associates

INTEGRAL SYSTEMS INC.

ABSTRACT

Title: Extended Uses of Human Resources Information

Integral Systems, Inc. (ISI) provides a fully-featured system to meet the Payroll, Personnel, Position Control, and Applicant Tracking requirements of colleges and universities. Exciting new uses of the information recorded to support those functions have been developed for both mainframe and microcomputer applications. Of particular interest to institutions of higher education are tenure tracking, budget modeling, graphic capabilities, and inventory of instructional skills. Other new fuctions included information download to spreadsheet packages, affirmative action planning, graphic organizational charts, succession planning, and flexible benefits programs. As the information requirements of Payroll and Personnel Offices continue to change rapidly, application systems must change to support their needs.

Lynn Kosmakos
Integral Systems, Inc.
165 Lennon Lane, Suite 200
Walnut Creek, California 94598
(415) 939-3900

THE KEY TO SUCCESSFUL SYSTEMS

Too often colleges and universities assume that their administrative systems can be improved merely by purchasing new hardware and/or software. That is far from the case. Certainly, tested and proven hardware and software are essential to having successful systems. However, it has been proved that these two elements are perhaps only 40 percent of the solution. The remaining 60 percent is dependent on the way the software is implemented, the knowledge developed during the implementation by people throughout the institution who operate the system or process transactions that affect the system, and, finally, the policies, procedures, forms, and methods used to effectively record and report transactions. These three elements must be in place to attain successful results for the institution. The investment in new systems is too large to be used ineffectively, and thereby requires a comprehensive approach to systems implementation.

PEAT MARWICK'S IMPLEMENTATION SUPPORT SERVICES

Peat Marwick provides systems implementation support services to colleges and universities. We have identified eight key implementation phases which are described below. Our experience indicates that each institution must perform these phases and related tasks effectively if a successful implementation is to result.

Peat Marwick's experienced professionals work with your staff to prepare them for the key tasks they must undertake to successfully implement your new systems. We will tailor our proven approach to the unique characteristics and needs of your institution.

Project Planning and Organization

Identifying project team members and defining their role, as well as the roles of others in the institution; developing a tailored, detailed workplan with target start and end dates; and developing a PERT implementation chart designed to meet your unique needs.

Functional Requirements Analysis

We assist institutions to prepare complete specifications of their needs. The intent of this effort is to define how the institution will make the best use of the capabilities of the new system, and changes that may be required in the system or in existing policies and procedures. This is accomplished through collecting and identifying the purpose and use of forms and reports; identifying major transactions; identifying major policy issues and options available; determining external requirements such as generally accepted accounting principles (GAAP) if an accounting system is being implemented; determining the logical structure of codes, such as the chart of accounts for an accounting system; and, finally, identifying how the information needs defined earlier can best be satisfied through code structure parameters specified in the new system.

Systems Development

Most systems need some form of modification; this is especially true for student information systems. Many times the vendor's software may require a modification, or perhaps the institution's own subsystems require a change to make them compatible with the vendor's software. We assist the institution during the various stages of systems development, and during this period we encourage continued testing of modifications and conversion programs.

Testing

Developing a detailed test plan for conducting tests of all system features. Providing for testing of modifications to systems of original entry and interdepartmental charging systems.

Documentation

We prepare user manuals to serve as instructions for preparing forms, processing transactions, and interpreting reports. These manuals are prepared for the accounting department, registrar's office, and payroll department, as well as for academic and support departments. The manuals are used as a reference and to train staff, especially new staff that join the institution after implementation.

Training

We develop and assist in conducting training sessions for user departments and management to ease the transition to the new system. Our training is tailored to satisfy the unique needs of the institution.

Conversion

The implementation of a system often requires that data in existing systems be passed to the new system. We assist in planning for conversion, specifying data that should be received from manual and automated systems. We will also provide assistance in the actual conversion effort.

Postimplementation Review

Once a system is implemented, it is recommended that a review be conducted to identify enhancements that may still be required to satisfy unmet needs. We assist institutions to conduct a postimplementation analysis.

The level of effort required from Peat Marwick will depend on our assessment of your needs. This will be confirmed in a written proposal letter. As appropriate, we may provide these implementation services in two stages: the first introductory, and the second more intensive.

For further information, contact your local Peat Marwick office or:

Frederick J. Turk	Herbert R. Hansen, Jr.	Sarah A. "Sally" Campbell
212-872-5848	212-872-6641	213-972-4000

ROLM Presentation For CAUSE
Summary
December 5, 1984

Voice and Data Integration

When colleges and universities evaluate strategies for data communications, an integrated voice and data network using telephone wire almost always emerges as the most cost effective alternative. The primary reasons are as follows:

- Twisted pair telephone wire is less expensive to install than coaxial cable and much less expensive than fiber optics. This is especially true for the wiring inside buildings which constitutes the majority of the wire, installation cost, and administrative attention.

- Since the entire campus must be wired for voice, and there will be more voice terminations than data terminations, data can essentially "ride for free."

Other reasons for preferring voice and data integration over separate networks are these:

- A universal wiring plan with a single medium (twisted pair) is less costly to manage and maintain than multiple media.

- Voice and data PBX's provide virtually 100% availability because voice users insist upon getting dial tone whenever they pick up the phone.

- The ROLM CBX II and other PBX's provide extensive usage measurement on internal and external voice and data calls.

- Voice and data PBX's provide easy interfaces to the public switched voice network, making efficient use of telephone trunks and of modem pools.

The ROLM CBX II provides the important advantage of ROLMlink, a technology which permits simultaneous voice and data transmission over a single pair of standard 24 gauge telephone wire. ROLMlink operates up to 3000 feet and allocates its 256 kilobit per second bandwidth as follows:

ROLMlink Bandwidth Allocation

Voice	64 Kbps
Data	64 Kbps
Control	8 Kbps
Reserved	120 Kbps

Though ROLMlink reduces the need for cable pairs and for conduit, its chief advantage for a university is that data capability can be added to any ROLMphones on campus without recabling. This provides tremendous flexibility and low costs for moves, adds, and changes.

636 To support higher bandwidths ROLM has announced ROLMbus 295 and Dynamically Allocated Bandwidth. ROLMbus 295 provides 295 megabits of bandwidth in each node of the ROLM CBX/II. Each node supports roughly 700 extensions. ROLMbus 295 will enable every user on the system to simultaneously hold a voice conversation and a 64 Kbps data conversation with transmission capacity still to spare.

Dynamically Allocated Bandwidth is a capability which will allow voice channels to be super-multiplexed into bidirectional data streams of up to 37 megabits per second. Super-multiplexing will work well for providing bridge and gateway functions between local area networks (LAN), such as Ethernet or the IBM token ring network. Dynamically Allocated Bandwidth will also provide a shared access mode that can be used to implement a packet switching service directly embedded in CBX II.

Desktop Products

Out of the ROLM family of desktop products (ROLMPhones, Cypress, Cedar, and Juniper), Juniper is of most interest to colleges and universities. Juniper consists of a digital ROLMphone connected to a standard size option card for the IBM PC, and ROLM's Personal Communications Software on a diskette. Juniper provides:

- One Touch Terminal Configuration - Parameters such as baud rate, parity, and echoplex can be set once for each database or host the Juniper user will access.

- Autodial - A single touch of the Autodial key automatically configures the correct terminal profile for communicating with a specific computer and establishes the data connection.

- One Touch Logon/Logoff - Antolog transmits multiple characters with one keystroke. Users no longer have to remember ID numbers, passwords, or other parts of the logon sequence.

- ASCII/Asynchronous File Transfers - Juniper provides fast and efficient transfer of both text and binary files to and from PC's, minis, and mainframes with features such as Auto-answer and Auto-dial. The prestored terminal profiles allow virtually one-touch data connection to a co-worker across the hallway or across the country.

ROLM Headquarters Voice and Data System

The voice and data network at ROLM's headquarters serves over forty host computers, 3800 data terminations, and 4500 voice terminations. The network is an excellent demonstration of the viability and value of large integrated voice and data networks.

The hosts include: fourteen mid-sized computers for marketing, finance and manufacturing; twenty-nine mid-sized computers for engineering research and development; two large mainframes for the ROLM Analysis Center (processes call detail records for ROLM customers), for technical publications, forecasting, and some engineering; and two special computers for CAD/CAM and other applications.

User terminal equipment include 85 ROLM Cypress Workstations, 450 personal computers and 1450 asynchronous terminals. There are 22 incoming Tymnet ports, a TWX/Telex interface, and 70 ports in modem pools. The network uses six ROLM Gateways to IBM environments, four bisync and two SNA.

CAUSE members are encouraged to contact their local ROLM representative for an update on the network or for a visit to ROLM's Santa Clara facility.

SPERRY

SPERRY CORPORATION
COMPUTER SYSTEMS
P.O. BOX 500
BLUE BELL, PENNSYLVANIA 19424-0001
TELEPHONE (215) 542-4011

SPERRY COMPUTER SYSTEMS: SUITE ACTIVITIES

PALS ELECTRONIC LIBRARY SYSTEM

The PALS online catalog and circulation system was announced as a supported product. This software provides complete automation services to medium and large libraries using the 1100 family of hardware. University libraries, city libraries, state libraries and research libraries will be pleased to see the features which the PALS System provides.

This system was originally developed at Mankato State University in Minnesota where it was accepted state-wide in 1981. Today it successfully satisfies eleven large libraries throughout Minnesota plus others in Canada and New York State. Sperry has purchased and now owns the system.

Demonstrations of this system are dramatic and can be arranged on-site for any university. Library administrators will be impressed when the system scans 1.6 million volumes, often in less than 1 second while serving 150 concurrent terminal users.

UNIX ANNOUNCEMENT

Sperry now provides a uniform UNIX System V environment across all product sets . . . personal computers, multi-user micro systems and 1100 systems.

When used on the Sperry PC, it becomes an excellent program development workstation.

The Sperry 5000 series is composed of four models supporting up to 64 users, with full connectivity to PC's, IBM and Sperry mainframes.

The Sperry 7000/40 series super mini computer offers UNIX solutions up to 128 concurrent users.

The Sperry 1100 UNIX solution is ideal for large application development plus mobility into and from other mainframe applications.

Shipments of UNIX systems (by all vendors) numbered 100,000 units in 1983. Growth is projected by Infocorp to more than 750,000 in 1988. Sperry is an early and successful supplier in this dynamic market.

Systems & Computer Technology Corporation

The Campus of the Future - A Public/Private Partnership

The development of comprehensive system solutions requires skilled management, modern technical expertise, and strategic, long-range planning. The results of a survey of FORTUNE 500 companies by the Nolan Norton Company recently appeared in the November 26, 1984 issue of Computerworld identifying barriers to software quality. Many of their findings are applicable to Higher Education and include:

- 60% of development projects will experience cost and schedule overruns.
- 75% of large systems under development will experience serious operational difficulties.
- The average large system software project runs more than a year behind and costs twice as much as originally estimated.
- Enhancements in a large program (250,000 lines of source code) usually require twice as much time and money to develop as first time stand alone programs.
- Large programs take 48-60 months to develop and average 300 serious errors per 1,000 lines of code.
- Software maintenance can run 80% of total development budget.
- Structured code, program generators and high level programming languages can increase productivity by 75%.

The SCT response is represented by fourth-generation technology, user group participation, and institutional partnerships as well as industry partnerships. As part of its commitment to higher education computing, SCT has established a multi-million dollar Research & Development Center for generating new software products. It continues to use multiple data bases (ADABAS, DM-IV, IDMS/R, IMS and TOTAL/TIS) and fourth generation languages (ADSO, MANTIS, NATURAL). Through its Enhancement License Agreement program (ELA), current clients access new technologies, decrease maintenance costs, increase system functionality, and create a living system concept as a result of participation. Institutional partnerships take on an R&D orientation, require a merger of resources and include lucrative financial incentives to the college or university. Industry partnerships involve joint marketing relationships formed with such data base firms as Cincom Systems, Cullinet, and Software AG, as well as with Big Eight firms such as Coopers & Lybrand and Deloitte Haskins & Sells.

One example of the public/private partnership exists between the University of Pittsburgh, SCT Corporation and AT&T. In creating the "Campus of the Future" project, the University of Pittsburgh established a goal of developing at acceptable costs a fully integrated, state-of-the-art computing and telecommunications system to meet University-wide academic and administrative needs over the next 5-10 years. Central to this goal was an integrated distribution system for voice, data and video communications, as well as advanced, cost-effective systems for academic and administrative computing, library operations and office automation.

In the administrative data processing area, SCT was selected as the principal corporate participant because of its advanced design administrative systems software. Specifically, the Integrated Student Information System, the Integrated Financial Information System, the Human Resources Information System, the Alumni Development System and the Fixed Assets System represent the core for administrative processing.

SCT systems were selected because they operated in a true data base management environment on state-of-the-art hardware. In addition to system capabilities, SCT offered the University financial incentives and priority on delivery, installation and enhancements. Similar to an arrangement with AT&T for voice, data and video communications, the University established a continuing open-ended R&D relationship with SCT.

When AT&T enters into a partnership program as it did at the University of Pittsburgh, criteria used for selection includes the institution's willingness to participate; the perceived impact on students, faculty and administration; the plan's compatibility with AT&T services; institutional resources to do the work and previous experience with AT&T. In considering candidates for partnerships, extensive technical information is required. This information consists of institutional background (location, total enrollment, faculty, departmental enrollment), research activity (dollars, projects, publications, status, results), market considerations (saleability of product to be enhanced/developed, target and timing) level of commitment, economic considerations (people, expenses, capital cost and impact) and other outstanding issues and recommendations. Additionally, an institution's prestige (degrees awarded and faculty on staff), their interaction with other industries and abstracts of proposed research and development projects are evaluated in establishing partnerships.

For details of the Campus of the Future Project and SCT's role in providing administrative systems solutions, please contact:

Jerry Young
General Manager
SCT Corporation
4 Country View Road
Malvern, PA 19355

(215) 647-5930

TEXAS
INSTRUMENTS

NEW DEVELOPMENTS IN ARTIFICIAL INTELLIGENCE

JOHN W. ALDEN
EDUCATION COMPUTER MARKETING

Texas Instruments has been a pioneer in computing technology for the past three decades. The next frontier for Texas Instruments computing technology leadership is artificial intelligence (AI).

ARTIFICIAL INTELLIGENCE: AN OVERVIEW

Artificial intelligence seeks to expand the boundaries of computer science to solve problems traditionally considered to require human intelligence. Traditional computing excels at problems that can be expressed in numerical terms and which lend themselves to repetitive, algorithmic solutions. However, traditional computing has not been effective in dealing with unstructured problems, interpreting information, using "rules of thumb" (heuristics) gained by experience, or dealing with uncertain or incomplete information.

TI has major research and development programs underway in key AI disciplines: symbolic processing computers, expert systems, natural language processing, speech recognition and computer vision.

SYMBOLIC PROCESSING

Symbolic processing is the manipulation by computers of information and knowledge represented as symbols. Symbols can be linked together, using structures such as networks or graphs, to represent such relationships as hierarchy and dependency. Symbolic languages, such as LISP, have a unique ability to incorporate and utilize heuristic problem solving techniques.

THE LISP LANGUAGE

LISP differs from other programming languages in that it is not an algebraic or algorithmic language, but instead provides the means for representing, storing, and processing knowledge through its ability to support symbols and non-numeric knowledge structures.

SYMBOLIC PROCESSING COMPUTERS

Symbolic processing computers are characterized by a dedicated LISP processor, large virtual address space, large amounts of physical memory, a high resolution graphics display, and high performance mass storage devices. The Texas Instruments Explorer system combines state-of-the-art hardware with a rich programming environment providing for increased programmer productivity.

John W. Alden
Education Computer Marketing
Texas Instruments Incorporated

EXPERT SYSTEMS

Expert systems are software programs that use sophisticated problem-solving techniques and large knowledge bases to solve problems beyond the reach of conventionally programmed computers. An important component of expert systems is a natural, user-friendly interface allowing people without extensive computer skills to use the system. Expert systems technology can be applied to many domains in which expertise can be formalized. Expert systems are now in use or being developed in such fields as computer-aided design and engineering, intelligent diagnostic and test systems, financial analysis, bioengineering, and manufacturing. The Texas Instruments Personal Consultant expert systems development tool provided a powerful LISP based software environment with the lower cost of a TI Professional Computer.

NATURAL-LANGUAGE PROCESSING

Natural-language processing allows people to communicate with computers in normal, everyday English, rather that in "computerese". The first commercial applications of natural-language processing have been data base interfaces, enabling users to retrieve and manipulate data by using ordinary English commands. Developed in TI's artificial intelligence research laboratory, NaturalLink^{TM} provides access to a number of popular data base services, and personal computer programs. TI's NaturalLink Technology Package provides software development tools and documentation for systems developers to build their own natural-language interfaces to their applications.

SPEECH RECOGNITION AND SYNTHESIS

The ability to understand normal human speech promises to be an enormous advance in the utility of computers. One major goal of TI's speech recognition research is speaker independence. Another major objective is continuous-speech recognition, whereby the computer could understand entire sentences.

COMPUTER VISION

Pattern recognition and image processing technologies developed at TI's corporate research laboratories are being used in the manufacturing of semiconductor and calculator products, as well as in various government electronics applications.

TI: USING AI TODAY

Texas Instruments has a large research program underway to discover new ways to use artificial intelligence technology throughout the corporation. Expert systems will help increase the reliability and production yields of our products by giving employees access to our knowledge of semiconductor design and manufacturing. Expert systems will assist designers of new VLSI circuits to increase productivity. In other areas of manufacturing operations, development of an interactive expert system aides in "self-tuning" process control applications, so that the optimal mixture of materials will

John W. Alden
Education Computer Marketing
Texas Instruments Incorporated

always be available to the production process. Research in a unique signal interpretation device that uses the latest computer vision and pattern recognition technologies will produce three-dimensional representations of seismic data. These 3-D images will be of significant benefit to the experts who have to determine, for example, the most promising locations to drill for oil. TI's natural-language and speech technologies are also being prototyped in a system, an electronic maintenance aiding device, using both speech recognition and speech synthesis to assist maintenance personnel with various aspects of equipment repair. Other systems will utilize speech technology to help pilots fly airplanes and helicopters. Texas Instruments has one of the world's largest corporate activities in artificial intelligence research and development.

THE TEXAS INSTRUMENTS EXPLORER SYMBOLIC PROCESSING SYSTEM

The Explorer system is an advanced single-user computer optimized for high performance symbolic processing. A high-speed LISP processor, large physical and virtual memory capacity, and a high resolution graphics display are standard in an Explorer system.

THE TI PERSONAL CONSULTANT SYSTEM:
EXPERT SYSTEMS DEVELOPMENT AND DELIVERY ON PERSONAL COMPUTERS

The TI Personal Consultant system enables the knowledge engineer to develop and deliver high-value knowledge based applications on a powerful but economically priced Texas Instruments Professional Computer.

EDUCATION COMPUTER MARKETING
PO Box 225474, M/S 8203
Dallas, Texas 75265

MIS MANAGEMENT ISSUES FOR THE 80'S

James M. Robinson,
Wang Laboratories

As more departments and individuals become users of microelectronic technology, it is critical that MIS management realize that the success of MIS will involve a formal consideration of the human dynamics that support or hinder the constructive use of office automation and personal computing technology. If we look at the past role of MIS on the campus, it is apparent that a change in management's perspective of its goals and objectives will be required for this to happen.

In the past management staffed its ranks with bright, formally trained MIS professionals who were comfortable with long interrupted hours of job-oriented activity, frequently in an environment isolated from the mainstream of the university. MIS goals, objectives, and definitions of success were created in the relatively isolated environment of the MIS department. While most management outside of MIS understood that somehow that the "computer department" was a distant relative of their own department, it was difficult for them to express what the relation was. The content of the communication between MIS and upper management was shallow, and more blind trust of MIS management existed than an actual understanding of what it was doing to benefit the whole institution.

We can all agree that things have changed. The evolution of personal computing technology and the sharp increase in the number of end-user applications have created a heightened interest in the workings of MIS, not only as a support agency to other departments, but also as a strategic contributor to the university policies and goals. The job-oriented MIS perspective of the past is currently being replaced by a process-oriented perspective of how hardware and software solutions --- administrative and academic --- can contribute to the long-range objectives of the university at large. With this change has come more incentive (if not pressure) for MIS management and its staff to come out of isolation and interact more purposefully with other departments, as well as an ever increasing number of individual end-users of its systems.

Often the real keys to successful interaction between MIS, upper management and users are hidden by concerns about hardware and software features and compatibility. However, hardware and software considerations in the 80's should be secondary to two issues that MIS management will have to face:

(1) the necessity of taking a strategic approach to establishing good communications between MIS and the university at large and

(2) the importance of encouraging departmental and end-user involvement and commitment to making MIS systems work well

Both of these issues can be addressed by communicating (verbally and non-verbally) to university management and the end-user community that MIS, as a service organization, is flexible, creative, and practical, as an integral component of the institution as a whole.

Communicating flexibility requires that MIS be highly visible within the institution as a department which is planning for change and is identifying where those changes can best be implemented. There should also be the perception that MIS management and its staff believe that a good interchange of ideas and input from the end-user community at large, is essential to implement those changes. While this does not mean that MIS should relinquish its responsibility as a steering and policy setting agency within the institution, it does mean that MIS should communicate that it realizes that it is the people, the would-be-users of the system, and their acceptance of it, which will make the system work --- or fail to work.

MIS should also project itself as a department which is willing to face and cope with resistance to change. It should be visibly analyzing and breaking down wrong attitudes toward change which exist today within the institution. In the past, the most expedient way of dealing with individuals who found it hard to understand "why the college needed a computer in the first place", might have been to ignore them, or in some way to get around them. Today, analyzing, if not empathizing with the viewpoints of these resisters, can be a good strategy toward establishing a constructive dialogue between MIS and the end-user community. Frequently the "resistance" shows up, not only in the support staff (eg. secretaries, where it is often anticipated), but within the ranks of management itself, in departments outside of MIS. How well resistance to innovation is handled, will be determined by the ability of the MIS staff to understand the viewpoints of the resisters.

The MIS manager and his department should not feel that they have to become social scientists; but, the successful manager of the eighties will cultivate within his department a sensitivity to "human factors" at the end-user level. Unless MIS is flexible enough to understand the people issues, it will bypass good opportunities to sell the value added benefits of the features and functions of its systems throughout the organization.

The second thing that management wants to convey is that the automated system allows for creativity. If end-users are given the understanding that our office automation and data processing system solutions allow for a certain degree of their own creative input, and can accomodate their own personal workstyles, they will be more enthusiastic users. As vendors and MIS professionals, when we impose a new set of controls about how users will perform in new work environments, if we want them to accept and be productive in these environments, and to not resist or reject them, it is essential that MIS communicate that the new system allows for, and encourages, their creative input as to how it is used.

The third important content theme of MIS communication throughout the institution should be that the system solution is practical. MIS will have the task of "selling" other departmental management on the short-term as well as long range benefits of the users themselves becoming throroughly involved and committed to making the system work efficiently. Departmental management will have to be sold on providing the required resources of people time, away from and at the work environment, for positive learning experiences to take place. As this is accomplished, the "practicality" of MIS system solutions will be defined from the bottom up, as they should be, and not from the top down.

Attention to the above issues will position the MIS department as an invaluable catalyst in the preparation of the campus institution for tomorrow's technology.

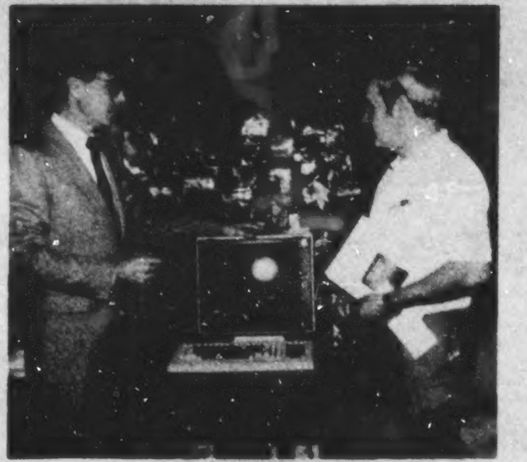
SUITE EXHIBITS

CAUSE84 included a number of Suite Exhibits set up by companies to display and/or demonstrate products. The photos on these two pages were taken in the suites during the Company Hospitality evening.

SUITE EXHIBITS

Helping Colleges
and Universities
Meet The
Information
Management
Challenge

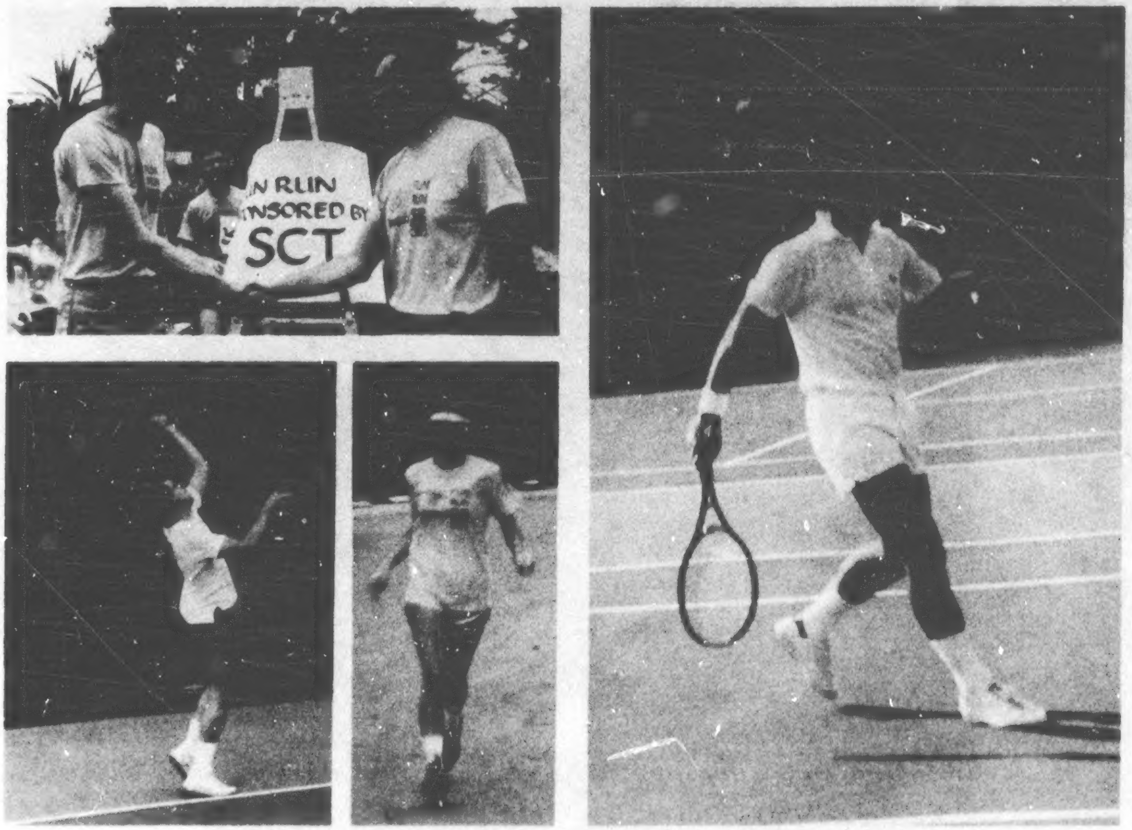
CATI
e Co rstone of Progr ss



BUSINESS AND PLEASURE

Ideas are exchanged as readily during breaks between sessions as they are at formal track presentations. An important part of the conference experience are the social gatherings—those that are scheduled as official conference activities, such as the Conference Registration Reception, as well as those that occur spontaneously as new friendships are formed and old acquaintances renewed during this annual event.

CAUSE84 featured three "special" activities—a Round Robin Tennis Tournament, a Fun Run (mini-marathon), and "A Night to Remember" at Sea World. The sports events were made possible by the sponsorships of two CAUSE sustaining member companies: Systems & Computer Technology Corporation (Fun Run) and Peat, Marwick, Mitchell & Co. (Tennis Tournament). The Thursday evening "Night to Remember" was a big success, as conferees and their families travelled in chartered buses to Sea World to enjoy a picnic dinner and dancing, followed by two special shows—"Beach Blanket Ski Party" and "Shamu, the Killer Whale."



REGISTRATION RECEPTION

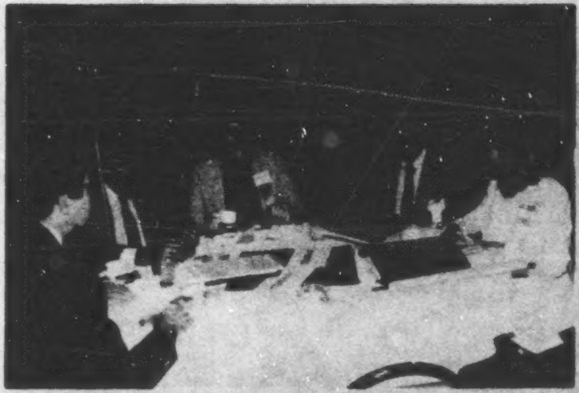
Special thanks to Martin Marietta Data Systems for their sponsorship of the CAUSE84 Registration Reception.

“A NIGHT TO REMEMBER”

REFRESHMENTS

Special thanks to Business Information Technology, Coopers & Lybrand, Digital Equipment Corporation, Hewlett-Packard Company, and PRIME Computer, Inc. for their sponsorships of refreshment breaks. DEC also provided coffee mugs, and Hewlett-Packard note pads, to all conferees.

BREAKS



CAUSE84